Aviation Week

Including Space Technology

March 24, 1958 75 cents

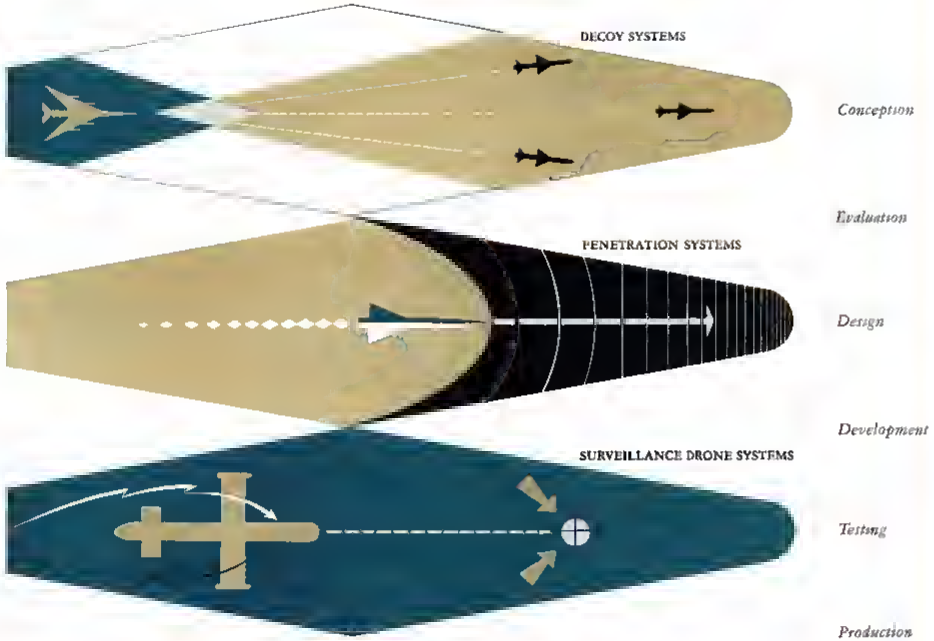
A McGraw-Hill Publication

First Design Analysis Of Saab Draken

North American XSM-64 Navaho

DRONE and SMALL MISSILE SYSTEMS

Research and Development at Rheem Aircraft Division has a record of achievement in the field of drone and small missile systems. The capability for complete "program management" is manifested in the list of current and completed projects and the areas of responsibility covered



Rheem Aircraft is a division of world-wide Rheem Manufacturing Company which operates 17 plants in the United States and with its associated and licensed companies operates 18 plants in 12 countries abroad. These extensive facilities coupled with Rheem's years of aircraft production experience provide the capability for the quantity production of drone and missile systems.

RHEEM MANUFACTURING CO./AIRCRAFT DIVISION
11711 woodruff avenue, downey, california

31

Engineers: Join Rheem in challenging technical work.

(*Advertisement*)

INTER-OFFICE MEMORANDUM

To Advertising Department *Subject* Recruitment Advertising for Engineers

From Vice President - Engineering

As the result of expanding activity in recent months, we have come up with a few openings for good engineers. Specifically, we need designers in the following product groups:

Pneumatic accessories
Electric motors
Fuel systems controls (pumps and valves)
Hytrol anti-skid braking system (electro-mechanical)

The requirements are not pressing: our present team can still carry the increased load. We're proud of the boys we now have, and it's important that we find exactly the right people to add to the group. Therefore, before you rush into print with the usual sort of "recruitment" advertising, here are some thoughts to use in formulating your message:

1. We don't hire engineers by the carload, and we don't stockpile them in reserve until the right project happens to come along. Our people are busy...very busy; and they like to be busy. They follow through on their ideas from inception to development and qualification. They feel a real responsibility for the hardware that finally results from their work. Therefore, we need more idea men with initiative and drive who are not afraid to get their hands dirty.

2. Don't write a lot of guff about "security" and "bright future." The kind of men we want carry their security around with them. They have the self-assurance that comes from ability and experience. Chances are they've known about our company for several years and have followed our progress in the industry. If they answer our ads, it means they like us - and they think they can help us to grow.

3. The kind of man we want will join us because we treat our engineers in the same way we treat our other key people. We don't isolate them and we don't put them on pedestals. We expect results; we know how to look for results; and we reward amply when we find them.

One other point: the man who meets our requirements is probably too busy to write a long resume and application letter. Just tell him to call me personally, or to drop me a short note to let me know where I can contact him - to Hydro-Aire, Inc., 3000 Winona Avenue, Burbank, California. Phone: VIctoria 9-1331.

FC

Frank Cooper
Vice President -
Engineering & Sales

FRC:mk

AVIATION CALENDAR

Apr. 8-10—Eighth International Symposia Electronic Waveguides, Engineering Societies Bldg., 29 W. 39 St., New York City.

Apr. 8-11—National Aeronautic Meeting Society of Automotive Engineers, Inc., Hotel Commodore, New York, N. Y.

Apr. 10-11—Aeronautical Training Society Annual Meeting, Mayflower Hotel, Washington, D. C.

Apr. 10-12—Southwestern Institute of Radio Engineers Conference and Electronic Show, St. Anthony Hotel and Municipal Auditorium, San Antonio, Tex.

Apr. 14-17—Design Engineering Show and four-day conference sponsored by the American Society of Mechanical Engineers, International Amphitheater, Chicago, Ill.

Apr. 16—Inductive Testing Requirements of Contacts Used in Aircraft Electric Systems," M. Trbovich, Hartman Electrical Mfg. Co., Engineers Club, Philadelphia.

Apr. 16-19—14th Annual National Forum, American Helicopter Society, Sheraton-Park Hotel, Washington, D. C.

Apr. 17-18—Institute of Environmental Engineers Second Annual Technical Meeting, New Yorker Hotel, New York City.

Apr. 21-23—14th Annual Meeting Metal Powder Assn. and Powder Metallurgy Show featuring applications of powder metallurgy parts in nuclear, jet and rocket engine fields., Sheraton Hotel, Philadelphia, Pa.

Apr. 22-24—1958 Electronic Components Conference, Ambassador Hotel, Los Angeles, Calif.

Apr. 22-24—1958 Annual Convention, International Airline Navigators Council, Picadilly Hotel, New York, N. Y.

Apr. 28-30—Second Annual Astronautics

(Continued on page 6)

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AVIATION CALENDAR

(Continued from page 5)

Conference, sponsored by Air Force Office of Scientific Research and fnstitute of Aeronautical Sciences, Shirley Savoy Hotel Denver, Colo

May 1 8—26th Annual Meeting, American Society of Tool Engineers, Philadelphia Convention Center, Philadelphia, Pa

May 4-7—Fourth National Flight Test In strumentation Symposium, Park Sheraton Hotel, New York City

May 5-7—1958 National Symposium, Professional Group on Microwave Theory and Techniques of the fnstitute of Radio Engineers, Cubberley Auditorium, Stanford University, Stanford Calif

May 10 14—16th Miami Havana Air Cruise sponsored by the Florida Air Pilot s Assn., Miami, Fla

May 12-14—National Conference on Aeronautical Electronics, sponsored by Insti tute of Radio Engineers, Biltmore Hotel, Dayton, Ohio

May 14 16—Spring Meeting, Society for Experimental Stress Analysis, Hotel Manger, Cleveland, Ohio

May 19 22—17th Annual National Conference, Society of Aeronautical Weight Engineers, fnc , Belmont Plaza Hotel, New York N Y.

June 2 4—National Telemetering Conference, Lotd Baltimore Hotel, Baltimore

June 9-13—Fourth International Automation Exposition and Congress, Coliseum, N Y., N Y.

June 16-18—Second National Convention on Military Electronics Sheraton Park Hotel, Washington, D C

June 24-26—31st Meeting Aviation Distributors and Manufacturers Assn., Mount Washington Hotel, Bretton Woods, N H

June 25 27—Air Transportation Conference, sponsored by American Institute of Electrical Engineers, Hotel Statler Buffalo, N Y For information S fl Fairville, Jack & Heintz Cleveland 1 Ohio

Jnly 4-6—All American Aviation Exposition, County Airport Pittsburgh Pa For details write All American Aviation Exposition, Executive Headquarters 210 Semple St , Pittsburgh 13, Pa

July 4-8—12th Annual All Woman Transcontinental Air Race from San Diego, Calif , to Charleston, S C For information write All Woman Transcontmental Air Race Inc 2611 Fast Spring St , Long Beach 6 Calif

Aug 19 22—Western Electronic Show & Convention fnstitute of Radio Engineers, Ambassador Hotel Los Angeles, Calif

Sept 3 7—1958 Farnborough Flying Display and Exhibition, Society of British Aircraft Constructors Farnborough England

Sept 6-14—International Aviation Show, Coliseum New York N Y

Sept 8-13—First International Congress of the Aeronautical Sciences Palace Hotel, Madrid, Spain

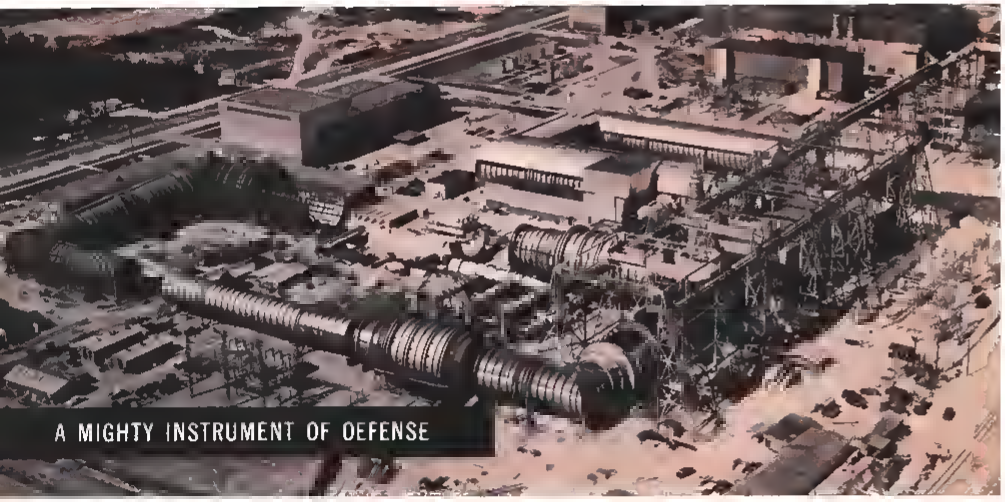
Sept 22 24—1958 Meeting Professional Group on Telemetry and Remote Control, Americana Hotel, Bal Harbor Miami Beach, Fla

Oct. 27—f4th Annual General Meeting of the International Air Transport Assn New Delhi India

One of the tremendous coolers (right) required in the Supersonic circuit—55' in diameter.

Transonic return duct No. 2 (below), with compresser and motor area under craneway in background.

Steel Platework by Pittsburgh-Des Moines



The Propulsion Wind Tunnel Facility at Tullahoma, Tennessee

The two largest wind tunnels of their speed in the country are shown built and under construction by PDM in the picture above. The Transonic Tunnel, now in operation, and the Mach 5 Supersonic Tunnel going up beside it each have interchangeable test sections 16' x 16' x 40' long—a measure of the great size of this massive project. The size and complexity of the work are in turn a measure of Pittsburgh-Des Moines' ability to meet dependably your most exacting platework requirements. Write us for engineering consultations and preliminary estimates on your forthcoming projects.

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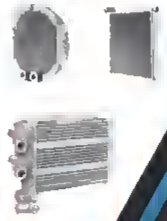
Checks heat on the Snark!

Harrison aircraft oil coolers—another quality product of General Motors research in the field of thermodynamics.



Quality qualifies Harrison for the rugged job of cooling Northrop guided missile!

The Snark blasts off in an inferno of heat—but Harrison keeps temperatures down to earth. With a trans-oceanic range, effective heat control over the engine oil is a *must* for this spectacular pilotless bomber. And Harrison heat exchangers were selected to do the job. Harrison's 47 years' experience in the heat transfer field delivers a top-quality product that's rugged and reliable—designed by General Motors engineers to *assure* dependable performance under the most severe operating conditions. That's why you'll find Harrison heat exchangers on so many of America's first-line weapons of defense—on land, at sea, and in the air. If you have a cooling problem, look to Harrison for the answer.

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GM

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March 24, 1958

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Including Space Technology

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COVER: North American XSM-64 Navaho supersonic intercontinental guided missile is photographed on launch pad at Cape Canaveral, Fla. Navaho is powered by two Wright RJ47 ramjets. Jettisonable booster separates at predetermined altitude and speed. Missile has inertial guidance, infrared homing. Navaho project was canceled in July. Tips of delta wings are equipped with aerodynamically balanced control surfaces.

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Cape Canaveral Revisited

Last week we spent a gray, rainy day trudging around the launching pads and blockhouses of Florida's Cape Canaveral known as "range station No. 1" to the 14,000 people who now man the Air Force Missile Test Center. This was our third inspection of the Cape and, except for the palmetto scrub and the lighthouse, it would be hard to recognize it as the place we first saw early in 1953 when Redstone and Matador missiles dominated the test program and the Air Force's first missile training group was firing Fairchild Larks for practice.

Now the Cape is dominated by the six giant twelve-story steel servicing gantrys for the Convair Atlas and the Douglas Thor with construction work well along on four test launching complexes for the Martin Titan. We saw Atlas No. 8 on the pad going through preliminary checks for the most sophisticated test shot yet attempted with this intercontinental ballistic missile. On another pad, the Redstone short range ballistic missile of 1953 had become the first stage of Jupiter C scheduled to launch the third Explorer satellite later this week.

Divine Guidance

Near the tip of the Cape, the Northrop Snarks are still being fired. In 1953, their early development problems stimulated snickers from commercial rivals about the "Snark infested waters off Cape Canaveral." Now the Snarks are flying 5,000 mi. downrange at high subsonic speeds with simulated megaton warheads and impacting near Ascension Island with guidance accuracy that top USAF development men say will not be achieved by any other missiles for a long time.

At the now empty Vanguard pad there was an air of happy relaxation and a feeling that the successful satellite shot on St. Patrick's day with a St. Christopher's medal added to the contractor's equipment proved that Divine Guidance is still a system requirement no matter what technical sophistication a fertile human brain can contrive.

Perhaps the key point in attempting to evaluate the significance of what has transpired at the Cape during the past three critical years of its growth is the fact that it has successfully kept abreast of the missile state of the art so that when new types of missiles reached the development test stage the range facilities existed to handle them adequately. This is a tribute to Air Force research and development planners of a decade ago, who foresaw the need for this type of facility, as well as to the current operators of the range and test center—Air Research and Development Command with its civilian contractors' Radio Corp. of America for range instrumentation and Pan American World Airways for range operation.

In a business where technical progress gallops at a rate that usually makes most test facilities obsolete before their concrete dries, this is a most unusual situation. When the Snark was ready to make its 5,000-mi. runs for accuracy, the range was sufficiently instrumented to handle it all the way to the Ascension impact area. Now that the Atlas and Thor are ready to make extreme altitude tests the Mark I Azusa tracking system is operational and capable of supplying pretty precise data on the missiles' position and flight path. The Azusa system is another technical windfall resulting from the old MX774 project at Convair in the mid-forties that also produced the gimballing rocket for control, integral fuel tankage and lightweight missile shell construction. The Azusa Mark I now operating at the Cape has also been combined with an IBM 704 computer to produce an impact predictor system that adds immeasurably to range safety by giving a running fix on where a missile will impact if it is destroyed at any time during its test flight.

When Atlas and Titan are ready to be tested for accuracy over their full 5,500 nautical mi. stretch, the range will be capable of handling them with a chain of 11 telemetering and radar tracker ships extending even beyond Ascension, an improved Mark II Azusa system installed at Eleuthera and an extremely long range radar at Trinidad.

This hard drive for effective range instrumentation has pushed the state of the art development hard in both electronics and optics.

When the U.S. space program was finally formulated in 1955, the Cape was able to provide the place for it literally to get off the ground and, even more important, the means to detect and progress from the inevitable early stage failures.

Even the natives of the sand spit between the Cape and Patrick AFB have caught some of the significance of this facility phasing. The construction of the new commercial Polaris motel is just a shade behind the building program for the Navy's Polaris missile test complex.

Problem vs. Performance

The Missile Test Center and range now have assets totaling about 400 million taxpayers' dollars. Nearly half of this sum has been poured into construction, range extension, instrumentation and new technical laboratory facilities since we last visited the Cape less than two years ago. Obviously a program of this size and complexity compressed into such a tight time schedule is bound to generate a host of vexing problems. It doesn't take an agile reporter in the area long to amass a long list of gripes both real and imagined from disgruntled civilian and military personnel.

But based on years of watching the Cape grow from little more than a rattlesnake haven and scrub palmetto into an extremely serviceable development tool solidly supporting the missile development programs of Air Force, Army and Navy, we believe kudos are in order for the men of ARDC, Pan American and RCA who have planned, organized and executed this job.

—Robert Hotz

WHO'S WHERE

In the Front Office

Maj Gen **Kenneth P. Bergquist**, Air Research and Development Command's Deputy Commander for Air Defense Systems Integration and also head of the newly named Air Defense Systems Integration Division, USAF, Hanscom Field, Bedford, Mass.

Dr. D. W. Elam, a vice president, Hiller Helicopters, Palo Alto, Calif. Dr. Elam will continue to head Adhesive Engineering Co. which is now a division of Hiller.

Carl L. Sadler and **Richard H. Olson**, vice presidents, Sundstrand Machine Tool Co., Rockford, Ill. Mr. Sadler will continue as general manager of Sundstrand Aviation Division, Mr. Olson will be in charge of the new Sundstrand Turbo Division.

Pat Cicala, a vice president, Waltham Precision Instrument Co., Waltham, Mass.

Abraham I. Dranetz, a vice president, Gulton Industries, Inc., Metuchen, N. J., and general manager of the newly created Clennite Instrumentation Division.

George M. Ballee, vice president and director of sales, Electro-Snap Switch & Mfg. Co., Chicago, Ill.

Lt. Col. William J. Seevers (USAF, ret.), assistant to the general manager, Niagara Frontier Division, Bell Aircraft Corp., Buffalo, N. Y.

Rear Adm. Frederic S. Withington, from Chief of the Bureau of Ordnance to Commander Naval Forces, Japan. **Rear Adm. Paul P. Blackburn**, from Chief of Staff and Aide, Commander, Naval Air Force, Atlantic Fleet, to Commander, U. S. Taiwan Patrol Force.

Honors and Elections

Don L. Walter, vice president-engineering and Van Nuys operations for Marquardt Aircraft Co., has been named Chairman of the National Advisory Committee for Aeronautics subcommittee on engine performance and operation, and a member of the committee on powerplants for aircraft. Other NACA appointments include: **Chandler C. Ross**, vice president-engineering for Aerojet-General Corp., named chairman of the subcommittee on rocket engines, and a member of the committee on powerplants for aircraft. **Dr. William J. O'Donnel**, chief engineer for aircraft and missiles development for Republic Aviation Corp., named chairman of the subcommittee on internal flow.

Changes

W. F. Miller, manager of Convair operations-Camp Cooke Air Force Base, Convair Astronautics, division of General Dynamics Corp., San Diego, Calif. **K. W. Jeremiah** succeeds Mr. Miller as manager of Convair operations-Edwards Rocket Base.

M. Carl Haddon, director of marketing, California Division, Lockheed Aircraft Corp., Burbank, Calif. **Robert A. Bailey** succeeds Mr. Haddon as chief engineer, and **Arthur E. Flock** succeeds Mr. Bailey as chief advanced systems research engineer.

INDUSTRY OBSERVER

► Series of staged missiles for hypersonic or high altitude tests is being built for potential industry users by Aerolab Development Corp., Pasadena, Calif. Off-the-shelf rocket stages are varied to meet test requirements.

► **Pratt & Whitney J58 turbojet being developed at the company's West Palm Beach facility is rated at about 30,000 lb. thrust and probably will be used in any Navy project utilizing nuclear power for aircraft propulsion.**

► Uneven heating and local hot spots on the rear fuselage of some hypersonic vehicles may prove as difficult to cool efficiently as the predictable maximum temperature areas on the leading edges. Hot spots would be caused by vortices which curl back over the fuselage as it develops lift. Location of the hot spots would keep changing with angle of attack and speed.

► **Air Force has vetoed a proposal to equip the Lockheed F-104 with experimental rocket controls similar to those being developed for the North American X-15 and other aircraft that attain altitudes where the atmosphere is not sufficiently dense for normal aerodynamic controls to function well.**

► USAF's Rome Air Development Center has requested bids for installation in the Caribbean of prototype ORDIR (omnirange digital radar) long-range radar system developed by Columbia University. Because the system determines azimuth by trilateration, one transmitting and several receiving stations located several hundred miles apart will be required. System will track missiles fired from Cape Canaveral for evaluation as possible eventual replacement for radars along the ballistic missile early warning line.

► **Each of three planned ballistic missile early warning sites to be installed for USAF by Radio Corp. of America will be operated by approximately 1,000 tech reps to be supplied by RCA Service Co. under a contract which will run for two years after the sites become operational. In addition to Millstone Hill type tracking radar, each site will include two split beam surveillance radars sweeping assigned horizontal angles to provide full coverage of Russia from the three sites (AW Feb. 24, p. 66).**

► Manned ballistic rocket research system study is being participated in by McDonnell Aircraft, North American Aviation, Convair and Avco. Work may make use of Fern drag ring studies.

► **Air Force has changed its operational requirements for Convair's B-58 supersonic bomber, eliminating the photo-reconnaissance capability. As a result, Fairchild Camera has lost its contract for manufacture of the planned camera and associated equipment for this application. Cost of reconnaissance pod program, including delivery of two prototypes, is $18 million.**

► Rolls-Royce attempted to sell Chance Vought its Conway bypass engine for the F8U-3 all-weather fighter, but Chance Vought is sticking with the Pratt & Whitney J75. Rocket motor in the dual powerplant Chance Vought F8U-3 will be supplied by Rocketdyne Division of North American Aviation. Key factor in the choice of the Rocketdyne motor was ability to deliver a unit earlier than Reaction Motors (AW March 10, p. 21).

► **Nord 5103 missiles are to be installed on the Fiat G-91 for tactical trials to meet a SHAPE requirement for ground attack. Single missile will be carried under each wing. Nord 5103 was developed as an air-to-air unit, weighs about 297 lb., is approximately 8½ ft. long (AW June 17, p. 56).**

► Russia's Mi-6 twin turbine helicopter will carry a five-man crew—two pilots, an engineer, radio operator and navigator. Latter two crewmen are often omitted on short test hops. Chief designer M. L. Mil's top assistants in building the helicopter were leading engineer D. T. Matsitskii and leading designer V. S. Otdelentsev.

► **Marquardt ramjet has been ground tested at 100,000 ft. and at a speed of more than Mach 2.5 in the Engine Test Facility at USAF's Arnold Engineering Development Center. Altitude is 30,000 ft. higher than that previously announced for air-breathing engines.**

Washington Roundup

Killian Secrecy

House Government Information Subcommittee headed by Rep. John Moss (D-Calif.) is looking into the secrecy surrounding the rapidly expanding office under Dr. James Killian, the President's scientific adviser.

Approximately 20 advisory panels reportedly have been named to pass on key defense and technical programs such as the nuclear aircraft program, the anti-missile missile program, etc. Not only is the membership of these panels placed in the "top secret" category but the designations of the panels also are classified "top secret." Moss last week directed a letter to Killian: "The House Government Information Subcommittee has been informed that information about the composition of the various advisory panels to your office is not made public. Would you please advise me of the authority for withholding this information? I would also appreciate any other comments you have on why this information is withheld."

ARPA Chief Scientist

Advanced Research Projects Agency has acquired a chief scientist who also will head a new technical studies group established to support ARPA in its mission of "appraising and developing specified areas of research in advanced space science and technology."

He is Dr. Herbert F. York, 36-year-old physicist who now directs Atomic Energy Commission's Livermore, Calif., laboratory. Dr. York will take a leave of absence. This is the fifth appointment to ARPA and the second from the atomic energy field (AW Mar. 10, p. 17).

Study group will be a new Advanced Research Projects Division of the Institute for Defense Analysis. In his capacity as head of the division, York will be ARPA's chief scientist. IDA is a non-profit corporation organized in 1956 under an association of universities. It works through Defense Department's Weapon System Evaluation Group and makes analyses, evaluations and reports on present and proposed weapon systems and other defense problems.

Defense Financing

The outlook now is that:

- **Defense Department will have to operate under a legally-established ceiling on expenditures.** This will channel down to defense contractors. They will have to be under a ceiling in order that the over-all defense ceiling will not be exceeded.
- **Long-range defense contracts** will continue to be backed up by appropriations from Congress.

These are provisions in legislation passed by the House (AW Mar. 17, p. 27), and likely to be accepted by the Senate. The version of the legislation as passed by the Senate a year ago would have directed—in addition to the ceiling on expenditures—that only "authorization" be given to Defense Department to contract for long-range items.

Cost Accuracy

General Accounting Office is pressuring Defense Department to set definite costs promptly on non-competitive bid contracts. In a letter to the Appropriations, Armed Services and Government Operations committees of the House and Senate, Comptroller General Joseph Campbell wrote:

"We recommend to the Secretary of Defense that prescribed contract clauses which provide for redetermination of prices during contract performance, include specific requirements pertaining to submission of the latest available experience costs. We were informed ... that such provisions are already incorporated in the redetermination clauses now being revised in draft form. We are asking the Secretary of Defense that these provisions be incorporated in the redetermination clauses at the earliest possible date because of the importance of contracting officials having current cost data in the negotiation and administration of contracts."

Johnsan 'Suggests'

Sen. Landon Johnson (D-Tex.), chairman of the Senate Preparedness Subcommittee, suggested to Defense Secretary Neil H. McElroy that he present detailed Defense Department reorganization plans to the subcommittee by April 2.

Johnson reminded McElroy that he told the subcommittee on Feb. 26 that he would have firm recommendations ready for Congress by the end of March. Johnson added that the press has carried reports that there will be no proposals and no changes in Defense Department structure.

"The best response to an allegation of inaction is always action," Johnsan said. "You are scheduled to appear before the Subcommittee April 2. ... I trust you will put at rest the uneasiness that has been engendered throughout the country by the rumors and that you will be in a position at that time to recommend the steps that are necessary to reorganize the Defense establishment in the interests of greater efficiency and effectiveness but without relinquishing civilian control."

Head-On Attack

Civil Aeronautics Board's chief information officer, William Kloepfer, Jr., has made a blunt attempt to end unfavorable press reports of the Board's General Passenger Fare Investigation. In a strongly worded letter that is not likely to set a precedent in the public relations field, Kloepfer scolded "more than 50" newspapers, magazines and commentators for having a "complete misunderstanding" of what the fare case is all about.

He told the press that "until now I have refrained from comment" on reports that the Board is "dragging its buttocks" or feet while the financial structure of the country's airlines is going to pot." He then explained that the purpose of the investigation is to gather facts to develop fare standards admitting that the Board in its 20 years of existence, had not yet developed this "essential working tool." He then revealed to the press that the Board is "well aware" that a sound air transport industry "must include the industry's capability to cope with rising costs and the acquisition of jet equipment, among other things." He suggested that the Board is ready to grant another interim fare increase if necessary and then expressed his hope that the public will "have a fair opportunity to judge whether the Board's decision against expediting the case is 'foot dragging' or evidence of a desire to guarantee the public and the industry the full measure of their rights."

—Washington staff

Engineer Recruiting Drive Gains Steam

Top-level, experienced technicians offered posts, but demand is off for graduates, junior engineers.

Aviation industry has sharply accelerated recruiting for top-level experienced engineers and scientists during the past 60 days. But demand for June graduates is off considerably from last year and run of the-mill engineers without a specialty or record of accomplishment are being turned away by many industry recruiters.

Aviation Week survey of 38 aircraft, missile, powerplant and avionics companies shows that 25 firms plan to expand the size of their engineering staffs by more than 10% in the coming year, six seek smaller expansions, seven plan no expansions at the moment.

New Outlook

Trans sitting pat are mostly aircraft and jet engine manufacturers while some in the missile, rocket engine and avionics field talk of engineering staff expansions of as high as 40%. Lockheed's Missile Systems Division has announced plans to hire over a thousand engineers and scientists during the coming year and has opened a large New York recruiting office. The expansion stems largely from acceleration of Lockheed's Polaris intermediate range ballistic missile program.

At the moment there is a significant difference between the present engineering recruiting picture and the one of a year ago. Practically every company surveyed emphasizes that it is being far more selective today in its hiring than a year ago. Representative comments include:

- **Jet engine manufacturer:** "Today, a man has to have more than an engineering degree to get an offer he has to have a specialty we need."
- **Avionics manufacturer:** "Last year at this time we were making offers to one out of every three engineers we interviewed; today the ratio has dropped to one out of eight."
- **Aircraft and missile manufacturer:** "We're making offers only to outstanding men, dropping our standards slightly to get electronic engineers."

Question is whether these standards will begin to drop if the competition for experienced, top-level engineers gets hotter. There are signs that recruiting drives are gathering steam. For instance:

- **East Coast avionics manufacturer,** which has done no field recruiting since last summer, will begin a major campaign next month.
- **Aircraft-missile manufacturer,** which has been without a recruiting shop at technical conventions for the last eight months will resume its previous practice at this week's Institute of Radio Engineers convention in New York.
- **Aircraft missile company,** which tried to place engineers with other companies when contract cancellations forced layoffs last spring, is receiving calls now from firms asking whether it has any surplus engineers. It hasn't; it is now out recruiting on its own right.
- **Aircraft missile manufacturer,** only one in a medium size eastern city, reports that nearly a dozen companies have run engineers wanted advertisements in the local paper during the past several weeks.

Not all companies report a sharp acceleration in competitive recruiting in their areas. Only a couple of companies surveyed admit any increased attrition of their engineers as a result of such recruiting pressures in recent months. Most report that engineering turnover is extremely low. This is attributed to the sobering effect of engineering layoffs in defense industries last summer and fall—the first in a decade—coupled with uncertainties in the national business pictures.

Anticipatory Hiring?

Selective recruiting of the moment appears to confirm company statements that they are hiring to meet firm needs and not stockpiling engineers in anticipation of future business. However, a recruiter for one jet engine manufacturer conceded that his company is trying to meet its estimated year-end needs by mid-year because it expects the market for engineers to become much tighter by July 1.

Recruiter for a major avionics company says he believes the next three months will tell whether the present situation will turn into panic-hiring. Another recruiter says the Institute of Radio Engineers convention recruiting activity will provide a tip-off as to how frantic the situation is likely to become.

Companies currently making their regular pilgrimages to the nation's engineering college campuses report a sharp change from recent years. Competition still is keen for the top 10-15% of the class, but many of these plan to stay on for advanced degrees because of premium on masters and doctors degrees. At the other end of the scholastic spectrum, some recruiters predict that men in the bottom third of their class may have trouble finding jobs before graduation.

Fewer companies are making the campus circuit this year and they are making fewer concrete offers than last year. Some are merely shopping, making no commitments for the moment.

- **East Coast aircraft-missile firm** is visiting only one-quarter as many colleges this year as last, interviewing three times as many seniors making only one fourth as many offers. These are going only to the top 10% of the class.
- **East Coast avionics company** hopes to hire 40 June graduates this year, compared to 120 hired last year.
- **Jet engine manufacturer** says it is seeking June graduates with previous military or industry experience in its line.

College seniors today are reported as "polite, a little worried." In previous years, the seniors sat back and expected the recruiter to sell his company. Today, the seniors are attempting to sell themselves to get a job.

Some June graduates are concerned over job security, express reservations about accepting a job with aircraft missile manufacturers in view of last summer's sharp defense cutbacks according to one recruiter.

Those in Demand

Strong demand for high level, experienced engineers appears to stem from current military emphasis on space technology with its requirement for major extensions of present knowledge. Long-range dreamer type of scientist, once considered a luxury that few companies could afford, is now coming into his own.

Electronic engineers are very much in demand, not only by avionics companies but by many of the aircraft missile manufacturers. Demand for mechanical engineers by avionic companies is picking up as a result of the need to design avionic equipment for greater ruggedness and problems of thermal design associated with cooling at high ambient temperatures.

Demand also is high for engineers and scientists whose aptitudes and experience qualify them for systems engineering and management.

Aviation Week's survey indicates that junior engineers, with less than three to five years experience, will not find many job offers in the present market unless they can point to top scholastic records and/or evidence of significant accomplishment on previous jobs.

Most companies are taking a "show me" attitude toward engineers who knock on their doors looking for employment, suspecting that these are the "culls" dropped by previous employers.

Many recruiters report that engineers seeking positions are making far greater use of employment agencies, less use of direct individual to company contact in their search for positions.

The present shortage-in-the-midst-of-surplus situation is reflected in the engineering salary structure. Starting rate for June graduates is about the same as last year, ranging between $450 and $550 per month, depending upon the man and his experience. Starting salaries for engineers with three to five years' experience also are holding relatively firm, perhaps dropping slightly.

Salaries being offered to high grade engineers and scientists with 10 years or more experience are moving up as companies bid for their services. Several recruiters say they expect this trend will continue as competition increases. One even predicts a rise of as much as 40% during the coming year.

Company recruiters are anxiously watching all the barometers, engineer-wanted advertisements, technical convention recruiting efforts and the responses to their own advertisements as they seek to gage whether the frantic recruiting of the past is returning.

Report beginning on this page on results of survey which reveal partial return of the engineering shortage was written by Avionics Editor Philip J. Klass, based on material gathered and compiled by editors in Aviation Week's Dallas, Los Angeles, New York and Washington bureaus.

Von Braun Warns Of Scientist Need

Washington—U.S. must not only produce more scientists and engineers but make better use of the talent already on hand, Dr. Wernher von Braun, chief of the Army ballistic missile development program, warned a special House Subcommittee on Education and Labor.

Von Braun said that between 30% and 40% of available scientists and engineers are idle because of cancellation of guided missile contracts. In addition, he added, there is great danger of valuable teams falling apart because of competitive bidding on contracts.

Von Braun explained that several contractors usually bid for a certain project and that unless the companies that fail to get the contract have other projects to work on immediately the scientific and engineering talent is wasted and valuable teams lost.

The Army scientist suggested that a placement program be worked out so that idle scientists or engineers be assigned to another project.

Space Technology

Explorer Nose Cone Temperatures Fall Into Normal Earth Ranges

Dallas—New details on Explorer I launching indicate the satellite is encountering temperatures in its orbit which are within the range considered normal on earth.

These and other details on the Army's first satellite were revealed by Wernher von Braun of Army Ballistic Missile Agency at the Joint Aviation Conference of American Rocket Society and American Society of Mechanical Engineers.

Explorer I report highlighted three days of crowded sessions which included discussion of new high energy fuel uses, dual thrust solid rocket application, and other subjects generally oriented toward advanced propulsion systems and space flight.

Space aspects of the conference were underscored by successful launching of the Navy Vanguard satellite last Monday. Commenting on the relatively wide orbit of Vanguard 1, Rear Adm. Rawson Bennett, chief of naval research, said it was the result of excess velocity and not of any errors in guidance or control. To give itself a safety margin satellite team padded the performance of the carrier beyond the theoretically required capability, he said, adding "the Russians did it, the Army did it and we did it."

Adm. Bennett told the conference that care must be taken to avoid over designing missile systems. Their main function is to do their assigned job, he said, and they shouldn't be any more sophisticated than necessary.

Gen. Thomas D. White, USAF chief of staff, said a key factor in space operations will be efficient direction of effort and centralized control. He said overall civilian control will rightfully be exercised, but due consideration must be given to military aspects of space research and operations.

Richard E. Horner, USAF assistant secretary, Research and Development, urged ARS and ASME members to help cultivate a sympathetic public understanding of research problems in order to assure a stable consistent program.

Lt. Gen. Samuel E. Anderson commander, Air Research and Development Command, observed that there has been much discussion of the need for research in solving the problem of getting man into space. He said that while research is important, the big job lies in development engineering—applying the available.

In discussing Explorer, von Braun reported that the temperatures recorded on the nose of the satellite ran from 270 to 340K, while internal temperatures taken near the low power transmitter (AW Feb. 10, p. 29) varied from 100 to 120F.

An interesting result noted by von Braun was the fact that the jet control vanes located in the exhaust stream of the Redstone first stage were eroded less by the extended exposure to the higher exhaust velocity of the new hydyne fuel than they were by the lower performance alcohol normally used in the Redstone. ABMA expected just the opposite and is still at a loss for an explanation.

The hydyne fuel which was developed by Redstone engine-maker Rocketdyne, is a 60-40 mixture of unsymmetrical dimethyl hydrazine and diethylene triamine. It is intended specifically as a replacement for alcohol. It can be used as a rocket fuel in existing systems designed for alcohol with only minor modifications in valving and the like and offers a 10-15% gain in performance. Hydyne has little or no advantage over hydrocarbon fuels as JP-4.

Translated into operational terms, this gain in performance means higher thrust or the same thrust over a longer firing time. As used in the first stage of the Explorer I carrier vehicle, it means both thrust was increased from 75,000 lb. to 83,000 lb. and burning time from 117 sec. to 150 sec. Part of this increased burning time, however, was due to the larger propellant tanks which ABMA engineers were able to use since the weight of the last three stages was less than that of the Redstone warhead which they replaced.

This increase in burning time meant that propellant had to be pumped over a longer time. In turn, this meant that more hydrogen peroxide had to be decomposed into steam to drive the turbopump. Consequently, ABMA engineers added another hydrogen peroxide tank.

Pre-launch procedure for the Explorer is much like the standard operation for

Pyrophoric Ramjet

Curtiss-Wright has designed a ramjet engine for use in high altitude target drones or missiles. It will burn pyrophoric fuel, a liquid which ignites spontaneously in air and produce speeds to Mach 1.5. It is 24 in. long 7½ in. in diameter and weighs 18 lb. The fuel, by its nature, eliminates the need for flame holders, ignition system and large fuel tanks.

High Temperature Plastic

New plastic process which enables molded parts to withstand high temperatures and friction heat has been developed by Hughes Aircraft Co Hughes material will stand temperatures up to 6 000F and exhaust velocity of 8,000 fps. Company expects it to be used in rocket nozzles, rocket blast deflectors, jet vanes, radomes and re-entry shields for intercontinental ballistic missiles

New plastic is an organic polymer system with random oriented reinforcement Material has a self-cooling feature under high temperature blasts A large portion of thermal energy is dissipated through insulation coating of degradation products on the plastic. Self-cooling occurs when decomposition and sublimation draw so much energy a shield forms between rocket blast and the molded material

all liquid propellant vehicles with some interesting and important differences At T-13 minutes, the top cluster of solid propellant rockets and satellite are set spinning at 450 rpm A governor lets the spinning increase slowly until about 20 sec before cut-off of the first stage motor when rotation reaches its maximum 760 rpm

Purpose of the governor is to keep the frequency of the spinning stages from reaching a level where it would resonate with the frequency of the first stage The spinning of course, is required to stabilize the final stages and to prevent thrust unbalance in event one of the solid rockets fails to fire

During countdown, a small package of dry ice is affixed to the vehicle near the top of the first stage to keep the instrument section of the carrier rocket cool At T-5 seconds the cooler, which is attached to long pole, is disconnected along with the "umbilical cord" of servicing lines which had been feeding into the missile.

At T plus 140 sec, two sensors in the first stage are alerted When they sense a pressure drop in either the oxidizer or fuel line they cut off the engine

The vehicle coasts for four seconds after cut-off to make sure there is no residual thrust in the first stage which could cause it to collide with the second stage after separation

Explosive bolts holding the second stage to the first stage are detonated and six springs gently push the second stage ahead at an incremental speed of one foot per second At this point the Explorer is at an altitude of about 50 mi

The vehicle continues to coast upward At T plus 405 sec, the final three stages reach their apex Four gyro-controlled compressed air jets align the final stages horizontally The attitude control jets work in opposite-directed units of two on a proportional basis As one outlet nozzle is closed by a certain amount, the opposite one is opened by the same amount Two units control pitch, two yaw To get into orbit, Explorer I had to be within four degrees of horizontal, it was at 81 deg

More difficult than obtaining horizontal alignment was the problem of determining and catching the moment of apex This is the critical moment at which the final stages must be fired to bring the satellite from a velocity of about 6,300 mph. to an orbital velocity of about 18,000 mph

To determine this moment, project scientists used three different methods to predict apex one based on data from a radar tracking; another, on telemetered data from an accelerometer within the vehicle, the third, on data from ground-based Doppler signals A nomogram was employed to get an average apex prediction and this was fed into a timer on the ground which ignited the rockets by radio signal Actually, the radio signal was sent to the vehicle shortly before it reached apex in order to allow for burning time of the rockets.

Total burning time of the Explorer's 15 solid rockets was 18 sec and this time had to be taken into account in catching the moment of apex

Data is still being received from the satellite's low power transmitter without any trouble or letup in signal Signals from the high power transmitter ceased after 13 days but unexplainedly returned twice after that. This mystery has now been solved After 13 days the power level in the transmitter batteries apparently fell below a certain threshold required for signal generation, then, somewhat like a "dead" car battery given a few moments respite from a starter button, they recharged themselves, twice reaching a level above the critical threshold

Dual-Thrust Motors

Dual-thrust solid propellant rocket motors are emerging as a practical alternative to the usual combinations of separate booster and sustainer motors, and the dual thrust approach has been successfully applied to at least one drone

Dual thrust motor with a duration of over eight minutes has been successfully tested in the Temco XKDT-1 target drone and the dual thrust technique is being evaluated for use in missile systems

Comparison of this new approach with the separate booster and sustainer technique was made by George E. Miles of Astrodyne, Inc. the successor to Phillips Petroleum Rocket Fuels Division which developed the XKDT-1 motor

Miles pointed out that integrating the booster and sustainer phases in a dual thrust motor eliminates the problems connected with jettisoning booster components This means increased reliability because there is no booster separation, and it eliminates the booster thrust alignment problem before launch.

Missile with a dual thrust motor could have the advantage of increased reliability due to elimination of ignition sequencing, could have a lower propulsion system gross weight, shorter length and lower propulsion system cost. Such a powerplant could improve chance for full missile control throughout flight because there is no booster to jettison, and, thus, no change in aerodynamic configuration

Miles conceded that the integrated dual-thrust motor does carry the dead weight of a spent booster phase while the sustainer is firing and that the dual-thrust motor demands much closer and earlier coordination of missile and propulsion system design He said the choice between dual-thrust and separate motors often depends more on the specific requirements of a missile, than on comparative overall specific impulse

Variety of configurations can be used with dual-thrust rockets For thrust ratios up to about 10, a single chamber unit appears preferable Miles said In a single chamber unit, thrust level can be regulated by mechanically changing the nozzle throat area or by changing propellant grain geometry or composition

Dual chamber unit has two separate chambers which can be arranged either concentrically or in tandem, according to Miles This type of dual thrust motor can use either single or multiple nozzles

Practical application of this dual thrust approach is the XKDT-1 motor described by J. A. Crask, of Astrodyne This motor gets its boost from a disk of higher burning rate propellent which is bonded to the aft end of the sustainer grain providing a simple, integrated two stage propulsion system

Sustaining phase propellent is a standard M15 Jato type, and the boost phase is similar Grain is a cylindrical extruded end-burning design.

Motor is 10 in dia and 59 in long, plus a 29 in blast tube which carries exhaust gas through the drone's tail assembly Motor is the center section, with nose and tail sections attached

In the drone the boost section of the motor burns for 3.8 sec, provides sea level thrust of 146 lb in a 60F firing Sustainer thrust at sea level is 46 lb, and the sustaining section burns 500 sec Drone speed is in the transonic area and it can operate up to 50,000 ft.

PROBE which measures Vanguard rocket angle of attack is adjusted by project engineers Arrow-like device is attached to tip of asbestos phenolic plastic nose cone Note actual 3.25 lb satellite sphere undergoing checks at left center of picture.

Space Technology

Vanguard's Success Forestalls Its Critics

By J. S Butz, Jr.

Washington—Successful launch and orbit of Navy's Vanguard satellite last week eased public pressure which followed the project's testing failures during the last three and a half months

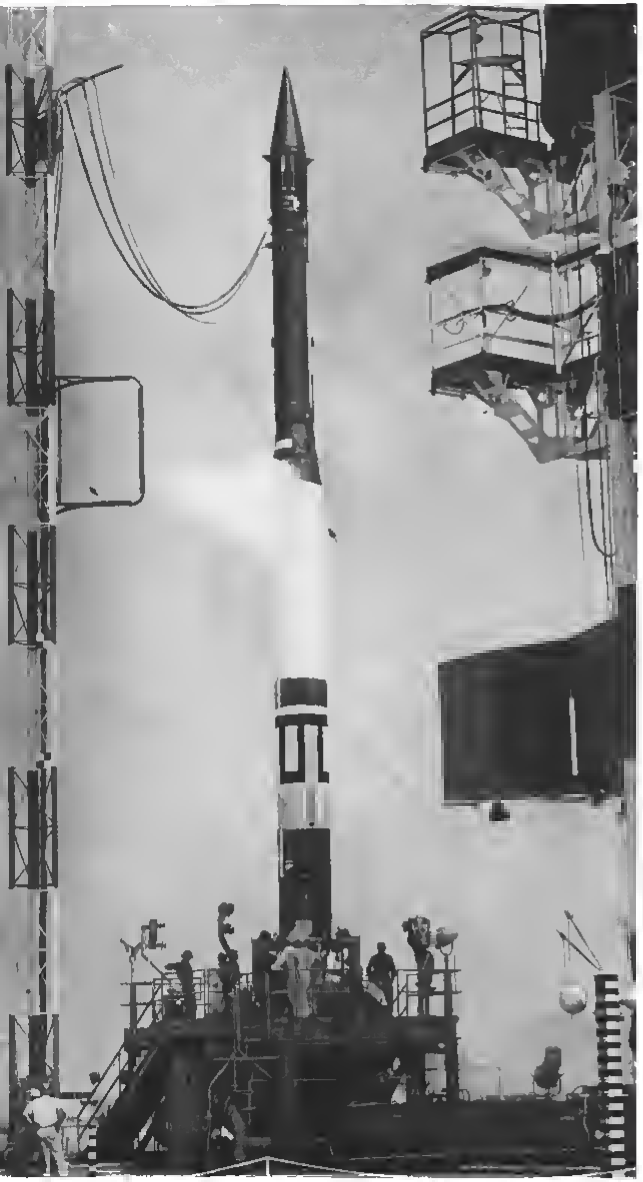
Disappointment and misunderstanding, which had taken a firm hold on large segments of Congress, the press and the public, turned to praise and broad statements of faith in U. S. technology as the sixth Vanguard test vehicle sent a 3.25 lb sphere into an orbit with a 2,513 mi apogee

Though there is some feeling that the Vanguard is a marginal project that is running behind schedule, the record indicates that it is one of the U. S.'s most successful high-performance rocket programs and has been progressing in near record time

The project was initiated approximately two and one-half years ago, and the complete specification has been firm for little more than one and half years This exceedingly short lead time makes the Vanguard one of the most advanced and efficient large U. S. rockets now in flight test

A number of improvements in structural and propulsion unit efficiency

CONTROLS of the Navy Vanguard TV-4 satellite vehicle are checked by Martin Co. engineers at Cape Canaveral, Fla., launching site Rocket was equipped with a backup ground system to take control of the guidance located in the second stage if it failed



GANTRY is rolled away from Vanguard as the pre-launching preparation approaches firing. Juncture of third and second stages (just above venting liquid oxygen) is a change from earlier vehicles in which the skin was flush.

have been made in the vehicle.

The project is well ahead of the original schedule which called for launching one fully instrumented 21.5 lb. satellite before the end of the International Geophysical Year next Dec. 31. This plan was altered last July and the smaller 3.25 lb. instrumented spheres were to be included in any complete test vehicle that would attempt to reach orbital speed. In this way, more useful information could be gained from the preliminary tests.

The Vanguard satellite now in space is the result of one of these tests, which Navy officials have described as a near optimum performance by every rocket component. It was the first flight test for the second stage.

On the strength of this the schedule has been accelerated, and the next test vehicle will contain a 21.5 lb. satellite instead of the small sphere previously programmed. This enlarges the program from six to seven attempts to put fully instrumented spheres into orbit.

Amount of the Vanguard funding has been in a confused state ever since the White House announcement in the summer of 1955 which stated simply that the National Science Foundation would spend $10 million on the satellite program. It has sifted through in bits and pieces that various Department of Defense funds would be added to bring this amount to a reasonable figure. Recent testimony before Congress indicates that total cost will stay below $110 million, a modest amount by present development standards.

The Vanguard firing record is well above average for the early stages of a development program, and the project will be fortunate to maintain it through the seven launchings which remain to be accomplished. Six test vehicles have been fired to date to prove out the rocket's various systems. Four of these firings have been successful for a .666 average, a very respectable figure. The furor over the Soviet earth satellite obscured this record, and the Vanguard was transformed from a military stepchild to a top priority program.

Technically, the rocket fired last week had one major change on the previously announced design. It was equipped with a backup ground system to take control of the guidance located in the second stage if it failed. This would insure that the spin stabilized third stage would be launched at the proper angle and would orbit if the necessary speed was achieved. The ground system used radar tracking information and a computer to present rocket course information to an operator who could take control although this was not necessary last week.

The satellite itself was made of aluminum coated with a thin film of silicon monoxide to control the internal temperature. The film radiates infrared, dumping heat, the quantity depending upon film thickness. Two radio beacon transmitters are carried in the sphere, one operating on batteries expected to last two weeks and the other from six solar cells in the outer surface. These were built for Vanguard by the Army and will provide broadcasting power in sunlight as long as they are undamaged.

The crystal of one radio is in thermal contact with the inner structure and the other with the outer shell. Therefore, the absolute temperature of the two structures can be determined from the change in signal frequency.

The next Vanguard rocket, to be launched as soon as possible, will contain a 21.5 lb., 20 in. sphere instrumented principally to measure ultraviolet radiation in the wave length designated Lyman-alpha. This type of solar emission affects radio communication and the weather. Measurements will also be made of temperature, pressure and collisions with micrometeorites.

Later Vanguard satellites will measure the strength of the earth's magnetic field, solar X-ray, cloud cover of the earth, total radiation of the sun, the reflected radiation of the earth and the density and distribution of cosmic rays.

Dr. Hagen in his recent statements indicated that Vanguard probably will not be shelved after the conclusion of the current program. The complete vehicle or its various stages which are among the most efficient units available are being considered for more ambitious space projects.

VANGUARD rocket launching which placed satellite sphere in orbit

Competition Planned For USAF Minuteman

Garden City, N. Y.—Air Force design competition for solid propellant intercontinental and intermediate range ballistic missiles which ultimately will replace Atlas, Titan and Thor will be held during next six months, according to Maj. Gen. Bernard A. Schriever. Program is believed to be the Minuteman multi-purpose ballistic missile project (AW Mar. 17, p. 21).

Commander of USAF's Ballistic Missile Division also revealed that Minuteman will employ an all inertial guidance system, whose contractor also will be selected during next six months.

Gen. Schriever made disclosure during visit here to Arma division of American Bosch Arma Corp. for signing of $140 million contract covering development of inertial guidance system for Titan ICBM. Contract includes approximately $53 million already spent by Arma to date.

ENLARGED nose on Soviet missiles displayed in Moscow during the Nov. 7 anniversary parade may indicate experiments in reducing effective radar cross section, in the opinion of some experts, although alternative reason would be to increase size of warhead as is done with some U.S. missiles

Cross Section Threat to Missile Detection

By James A. Fusca

One potentially feasible way of making long range detection of missiles even more difficult is by reduction of the missile's effective radar cross section obtainable with techniques currently being explored in the U.S. and Russia.

This problem, and the decoy problem, apparently have been postponed as "second generation" in estimates of effectiveness offered for Army's Nike Zeus and Plato, and USAF's Wizard anti-missile missile systems.

Nominal value for the radar cross section (apparent size) of an incoming ICBM warhead used in calculating range and probability of detection for these missile defense radars is 0.2 square meters, based on experimental work performed in 1950-52. Present techniques however, can reduce the apparent size of a warhead by a factor of between 10 and 1,000.

Theoretically, the geometric shape with the smallest cross section when viewed from only one direction is an infinite cone seen from the nose-on angle. The only backscattering of energy from such a shape would be from the tip of the cone, and the effective cross section at radar frequencies would be about one millionth of a square centimeter.

For the practical problem of missile warheads, minimum cross section is obtained by approaching as nearly as possible the electrical characteristics of this theoretical shape by adding a cone-shaped nose to the warhead and varying the contours of the faired base section to minimize backscattering and diffraction.

Because the cone shape is not satisfactory for re-entry, artificial nose cones are under study that would burn off. Inflatable cones shrouded to provide good conductivity also are being studied.

With a conical nose, diffraction or backscattering of electrical energy around the rear surfaces of the warhead become the key problems. A hemispherical base would diffract energy around itself and direct it back in the direction of origin. A flat base would have sharp edges that would backscatter large amounts of energy.

The optimum shape, therefore, is a conical forward section fairing into a base section that is curved but not a surface of revolution. That is, the rear section of the missile should look like a hemisphere warped so that energy diffracted around it will not return to the point of origin.

Also under study are techniques for including spikes or sharp edges on the rear section capable of launching energy diffracted around the base in a rearwards direction, and absorbing material to create phase interference or simply to convert the energy to heat.

Both in the case of diffraction and backscattering there is a significant dependence on frequency.

• **Diffraction.** The maximum energy is returned in the direction of origin when the wave length approaches the order of the dimensions of the warhead, with a fall-off toward zero in both directions from the maximum. In the area of maximum energy return, the energy level will oscillate rapidly with peaks and valleys as the wavelength changes.

• **Backscattering.** Backscattering of energy from the cone tip and from any edges present varies directly with wavelength: the longer the wavelength, the larger the energy return. The smaller the cone angle is, the less the energy that will be backscattered.

Studies of electromagnetic diffraction and scattering from bodies of different shapes antedate Lord Rayleigh, but some of the most important modern contributions have been made by a Russian scientist, Vladimir Aleksandrovich Fok, who was awarded a Stalin Peace Prize in 1946 for work leading up to a report entitled "Diffraction of Radio Waves Around the Earth's Surface."

Although the question as to whether Russia is ahead of this country in this area of study is argued pro and con by U.S. scientists many believe that the significance of Fok's work and its application to missile cross section reduction is just beginning to be understood here.

Many of Fok's papers on the subject have been translated and printed in a collection published last summer by Air Force Cambridge Research Center. Identification number of the document is AFCRC-TM-57-102.

Theoretical and experimental studies of the general scattering and diffraction problems are presently underway at the University of California in Berkeley, Ohio State University and the Institute of Mathematical Sciences of New York University.

Specific problems in reducing missile warhead cross sections are being studied at Air Force Cambridge Research Center, Cornell Aeronautical Laboratory, the University of Michigan, and Radiation, Inc.

A simple and direct method of analyzing problems of this type has been developed by Dr. Joseph Keller of NYU's Institute of Mathematical Sciences. The method is said to conform more accurately in some respects to experimental evidence than the method of analysis used by Fok.

Correction

Due to a typographical error, Aviation Week's March 17 issue, page 18, inadvertently reported that cost per successful mission for USAF's Minuteman multi-purpose ballistic missile "is expected to be considerably higher than anything developed or proposed so far." The sentence should have read that cost per successful mission is expected to be "considerably lower than anything developed or proposed so far."

United Aircraft Names Two Vice Presidents

United Aircraft Corp. has announced two executive changes to become effective April 1. Wright A. Parkins, chief executive officer of Pratt & Whitney Aircraft Division, will become United's vice president for engineering. Leonard C. Mallet, now general manager of Pratt & Whitney's Connecticut operations, will become a vice president of the corporation and act as general manager of all of Pratt & Whitney's operations.

The changes will take effect upon the retirement of Leonard S. Hobbs as United vice chairman after 30 years with the corporation.

Stapp Reassigned

Dallas—Col. John P. Stapp of rocket sled fame has orders to report to Wright Air Development Center where he will head the USAF Aero Medical Laboratory. Maj. David G. Simons will take over Stapp's job as Chief, Aeromedical Field Laboratory, Air Force Missile Development Center, Holloman AFB.

Soviet Bison Carries Nose Probe

Nose probe is visible in this view of Soviet four-jet Bison heavy bomber. Bulges on forward fuselage may contain cameras, counter-radar devices and reconnaissance equipment

Space Technology Gains Pose New Industry Fiscal Problems

Washington—Although Defense Department will place $10 billion in major procurement orders in the six-month period ending next June 30, Aircraft Industries Assn. President Orval Cook warned last week that the swift pace of technology has created financial problems of a magnitude heretofore unknown in the aircraft industry.

Missile and aircraft orders for the six months will total $6.9 billion compared to $4.74 billion in the first half of Fiscal 1958.

Aircraft orders for the January-June period will total $4.682 billion, or 57.2% of the Fiscal 1958 obligations for aircraft. Missile orders will total $2.227 billion for the six months. This is 64.4% of total missile obligation for the fiscal year.

These cost estimates were reported to President Eisenhower in a letter from Defense Secretary Neil H. McElroy. Obligations for major procurement items totaled $1.2 billion in January, McElroy said, but they will rise to an average of $1.7 billion to $1.8 billion for the last five months of Fiscal 1958.

Military construction obligations ran unusually low in the first half of Fiscal 1958, rose to $87 million in January. The remaining $1.7 billion in the program will be spread over the February-June period, McElroy said.

Administration is attempting to use this increase in defense contracting to bolster the nation's economy by favoring surplus labor areas and small businesses.

Asst. Defense Secretary for Supply and Logistics Perkins McGuire has asked the services to instruct contracting officers and all prime contractors holding contracts for more than $1 million to give preference to surplus areas and companies employing fewer than 500 persons wherever companies are qualified and bids are no higher than bids from firms in non-surplus areas.

McElroy also asked Congress to extend the Renegotiation Act for two years. He predicted expenditures subject to renegotiation for Fiscal 1959 at $18 billion and estimated they would run $19 billion each for Fiscal 1958 and 1959.

Major improvements in pricing policies and contracting techniques have been achieved, McElroy said, but changing technology and increasing complexity of weapons have made it harder than ever to forecast the possibility of excess profits. Renegotiation Board now is running two to three calendar years behind in its determination of profits.

Meanwhile renegotiation delays came in for sharp criticism from AIA President Cook, along with the industry's low earning rate, decreased progress payments, increased responsibilities for financing research development, test and production facilities and increased difficulty in acquiring capital to finance all this.

Cook criticized the lack of decision in government and said "the temper of the American people is such today that we can expect to receive adequate

funds whenever decisions are made that they are needed'

Industry's problems, he said, are financial Cook cited the case of 15 major airframe missile and engine manufacturers who he said

• **Increased net investment** in facilities from $140 million to $429 million from December, 1950, to December, 1956—an additional investment of $289 million after reserves and depreciation These facilities are primarily suited for development and production of military weapons, Cook said The money is "risked"—and if the type of weapons that will ultimately be required in 1960 65 changes significantly, (it) could well then be described as "gambled," he said.

"Even existing backlogs can be wiped out very suddenly if any new scientific developments are made that make obsolete a particular product under manufacture"

• **Increased their investment** in accounts receivable and inventories from $701 million to $2 362 billion in the same six years, partly as a result of progressively reduced progress payments for work already performed on fixed-price and cost plus-fixed fee contracts

Reduced progress payments have forced the industry to finance a larger share of work for government than for commercial customers Cook said.

Three principal ways to acquire capital and their relation to industry's problems Cook said, are

• **Retained earnings.** "This industry has for a number of years reinvested a greater percentage of our earnings than any other manufacturing industry" Capital that can be accumulated this way is limited by total earnings and by stockholder dividends, "particularly if one ever hopes to compete in the money markets again for new equity capital'

• **Borrowings.** "From Dec 31, 1950, through Dec 31, 1957, 15 of our major airframe, missile and engine manufacturers increased their borrowings from $25 million to $563 million, or 23 fold," Cook said "We certainly are approaching the limit of our borrowing capacity"

• **Sale of equity securities** Cook quoted a recent report of the Aviation Securities Committee of the Investment Bankers Assn of America, which said that "free competition in the investment market has reduced aircraft manufacturers to a low priority for new capital investment Due to the above shifts in Defense Department policy as much as to historic industry problems the investment community has judged aircraft manufacturers' stability inadequate for the risks involved"

Norden-Kelay Bid

East Hartford, Conn.—United Aircraft Corp has offered to buy the assets and business of Norden Ketay Corp., and Norden Ketay's directors have approved. The offer is subject to approval of United's directors and approval of Norden-Ketay stockholders United would exchange one share of common stock for 20 shares of the avionics firm

Borrowing Marks Industry Reports

New York—Douglas Aircraft Co's plan to sell up to $60 million in non-convertible sinking fund debentures is regarded by financial observers here as the last borrowing step Douglas will need to finance the development expenses of its DC-8 jet transport

Douglas' problem is complicated by reductions by the government in progress payments Previously a $150 million line of bank credit had been established by the company, and early last year it sold $27 million in convertible debentures.

With the proposed new issue, Douglas would thus have working capital available for DC-8 expenses plus whatever extra inventory burden is thrown on the company by the government payment reductions

Financial reports of other aviation companies reflected this same problem last week Thompson Products, Inc., spoke of quick retrenchments it was forced to make in the wake of Defense Department cutbacks

Severity of these eased abruptly after the Russians launched the first Sputnik, the Thompson report said. Incoming orders since the first of 1958 have been higher than the last months of 1957, but this may not indicate results for the year Thompson said

General tenor of the 1957 reports, while wary of pitfalls in the future, gave no cause for pessimism. The most frequent phrase in them was "record sales" Here are the latest company reports

• **Martin Co.** Bank borrowings of $25 million in short term notes its full line of bank credit were required by Martin last year because of the defense cutbacks Martin is negotiating further with banks for additional credit to meet its needs this year The credit has been assured and borrowings are expected to peak out in mid-1958 and be substantially reduced by year end

Martin's net sales were $423,925,000, a record except for World War II earnings Net income dropped from $10,800,000 in 1956 to $9,880,000, a result of the Defense Department contract payment changes

• **Chance Vought Aircraft Inc.**, doubled its sales over 1956 reaching record total for the company of $237,292,770 Net income was $6,152,383, or $5.65 per common share compared with $4,135,181, or $3 81 per common share Company declared its optimism about 1958, pointing out its backlog of $670 million in aircraft and missile orders meant substantial production into 1960.

• **Chrysler Corp.** Defense order backlog held by Chrysler Corp increased last year from $100 million to $300 million Thus includes medium tanks, fire control equipment and trucks in addition to its contracts for Army Jupiter and Redstone missiles and a utility VTOL vehicle Chrysler sales reached a new high of $3 564 billion with defense sales contributing 3.5% or $125 million

• **Thompson Products.** With 72% of its operations devoted to defense products, Thompson Products reported 1957 sales of $368,578,428 Net income of $11,942,034, or $4 20 a share was reduced by defense cutbacks from $13,012 605 or $4 60 a share in 1956

• **Kaman Aircraft.** Record sales of $15,385 700, compared with $12,380 865 the year before, were reported by Kaman Aircraft Corp

J57 Overhaul

East Hartford, Conn.—USAF has extended the time between overhauls for the Pratt & Whitney J57 engine from 800 to 1,000 hours. The J57 went into service on B-52 bombers in 1951 with overhaul time of 50 hours Last December. 99th Bombardment Wing of the Strategic Air Command reported that J57s in its 45 B-52s at Westover AFB had completed 100,000 engine flight hours without an engine being sent off the base for repair or overhaul

UAW Signs Contract With Chance Vought

Dallas—First contract settlement in the current round of labor negotiations with major aircraft companies came last week when Chance Vought Aircraft, Inc., signed a contract with its United Auto Workers Union local

Economic settlement makes up a package of about 14 cents an hour, including wage increases and fringe benefits Thus falls considerably short of the package estimated at more than 30 cents an hour originally demanded by the UAW local Wage increases range from eight to 11 cents an hour.

Union accepted a two year contract with a clause that allows reopening of the contract on wages and vacation provisions at the end of the first year

While the union didn't get the cost of living escalator clause it wanted Chance Vought did agree to improve the automatic progression portion of its wage plan, providing raises to about 3 000 employes in addition to the general wage increases

Company accepted the principal of compulsory arbitration in selected areas but held firm against blanket compulsory arbitration Union itself was extended the right to make a grievance, and grievance procedures were liberalized

Provisions were included in the new contract to ease impact during lay-off periods and the company agreed to extend union representation to employes transferred to off-site bases and will continue the union dues check-off for such employes

WV-2E Carries 9-Ton Rotodome

Nine ton Rotodome and support pylon top Lockheed's WV-2E radar picket Super Constellation, delivered last week to the Navy Air Development Unit, South Weymouth, Mass., where it will undergo six months of tests and evaluation. New AN/APS-70 airborne early warning radar used with 37 ft. truncated parabola mounted integrally with the rotating radome will provide approximately 70% more range than AN/APS-20 radar of standard WV-2 aircraft Eventually Navy hopes to add height finding capability to AN/APS-70, but WV-2 presently is equipped with AN/APS-45 height finding radar with nodding antenna mounted in Rotodome support pylon. For aerodynamic stability aircraft flies with 3,700 lb. of lead in forward baggage compartment, but much of this ballast will be replaced by additional electronic equipment as it is delivered by the manufacturer

Maj. Simons to Receive Two FAI Awards

Los Angeles—Air Force Maj. David C Simons will be awarded the Gold Medal of the Federation Aeronautique Internationale at FAI's 51st General Conference here on April 14 for his free balloon flight to 101,516 ft

Maj Simons also will receive FIA's de Lau Vaux Medal which is awarded to persons who have broken world absolute records for his balloon flight last Aug 19 20

The annual Gold Medal award is presented "to those persons who have contributed greatly to the development of aeronautics by their actions, work, achievements, initiative or devotion to the cause of aviation."

The de Lau Vaux Medal also will be given to USAF Maj Adrian E Dren who established the world speed record of 1,207 6 mph. last December in a McDonnell F-101

Paul Tissandier Diplomas will be presented to three U S recipients at the conference for "their work, initiative and devotion" in serving the cause of aviation

They are

• **Robert B Hotz,** editor of AVIATION WEEK, "for extensive aviation writings leading towards enlightenment of the American public on the progress and development of U-S aviation"

• **Joe Crane,** president of the Parachute Club of America, "for the effort expended in connection with the progress and development of the sport of parachuting in the U S"

• **Dr Leslie A Byram,** director of the Institute of Aviation, University of Illinois, "for the effort expended in connection with the progress and development of aviation education in the U S"

• **Albert L Lewis,** editor of the American Modeler, "for the effort expended in connection with the progress and development of aeromodelling activities in the U-S"

News Digest

Lt Gen Donald L Putt, Air Force deputy chief of staff for development will retire this summer shortly after completion of 30 years of service on May 30 He will be succeeded by Maj Gen Roscoe C Wilson, now USAF member of Defense Department's Weapons System Evaluation Group Gen Putt is expected to take a post in private industry In another move, Lt Gen William H Tunner deputy chief of staff for operations, will succeed retiring Lt Gen Joseph Smith as commander of the Military Air Transport Service Lt Gen Dean C Strother, commander of the Air University at Montgomery, Ala., will succeed Gen Tunner at the Pentagon

Soviet Stand May Block Aeroflot Growth

Russia's refusal to reciprocal exchanges could bar New York route; threatens British bilateral pact.

By L. L. Doty

Washington—Russia's plans to expand its international air routes outside the Iron Curtain have hit an impasse that may bar the way to direct air service between Moscow and New York.

Russian refusal to exchange air routes on a reciprocal basis already threatens to delay implementation of service between Moscow and London under the terms of a bilateral agreement signed with Britain late last year (AW Dec. 30, p. 33). Service between the two capitals was scheduled to begin in June or July.

Aeroflot Problems

Here are some of the factors blocking Russia's expansion program for Aeroflot, Soviet-owned airline:

- **Russians** have historically avoided any talk in bilateral negotiations of fifth freedom rights, the right of one country to carry traffic from a second country to a third. U. S. will insist upon the inclusion of fifth freedom in any bilateral agreement signed with Russia.
- **Negotiations between Russia** and Scandinavian countries covering transit privileges or the right of Aeroflot to fly beyond Copenhagen to London were recessed earlier this month. The Scandinavian countries are backed by the U. S. in their stand that such rights will be granted only in exchange for similar rights to Scandinavian Airlines System (SAS) to fly beyond Moscow.
- **Soviet Union** is not a member of either the International Civil Aviation Organization or the International Air Transport Assn. U. S. will stand firm on such IATA standards as rate fixing and ICAO standards, including airworthiness and the use of the English language in air traffic control functions. British have conceded to the use of the Russian language at the Moscow airport, English at the London airport.
- **Noise level of the Tu-104** jet transport, scheduled for service by Aeroflot on the London-Moscow route, fails to meet British requirements. A high noise level will certainly ban any turbine equipment from New York International Airport.

When the bilateral agreement between Britain and the Soviet Union for the London-Moscow service was signed late last year, no obstacles appeared to stand in the way of inaugurating service between the two countries for the first time. The Soviets made a number of major concessions in order to reach a final agreement.

Russia, however, ran into an unforeseen hitch in its plans when it opened talks with the Scandinavian countries on transit and landing rights in Copenhagen. Although Aeroflot now holds "terminal" traffic rights in Copenhagen under the terms of a bilateral agreement signed March 31, 1956 for direct service between Copenhagen and Moscow, it does not have rights to fly "beyond" the Danish capital.

It is the first time that the Soviet Union has been faced with the problem of bargaining for routes within Soviet territory other than the direct Moscow route. With one exception—the recently signed agreement between India and Russia—Soviet bilateral agreements always have been on a straight terminal-to-terminal basis. The Soviets have never touched on fifth freedom rights.

Soviet Concessions

In the case of the bilateral agreement with India, Moscow was forced to make a number of concessions to the Afghanistan government in order to obtain "beyond" rights through Kabul. In the agreement, Aeroflot gained rights to fly through the Afghan capital to New Delhi in exchange for rights to the Afghan airline to fly beyond the city of Moscow.

The agreement does require that only native pilots serve as crew members and since Afghanistan does not have trained airline pilots, suitable aircraft or even an airline, the Russian offer of Moscow transit rights was hardly over-generous.

A demand by the Indian government for a route beyond Moscow in exchange for an Aeroflot route beyond New Delhi was flatly rejected by the Russians despite a desire to spread its route pattern to Burma and Indonesia. Undoubtedly, the Russians realized India could make good its intent to fly a commercial route through Moscow to Western Europe.

Russian attempts to bargain with Japan for a route into Tokyo are not likely to show much progress unless the Japanese are given an opportunity to operate into Moscow. One offer by Communist Party Secretary Nikita Khrushchev for an exchange of routes between Tokyo and Khabarovsk was promptly turned down by the Japanese.

Japan wants a direct route to Moscow as an important link to Western Europe and probably will hold out for such a route before it gives anything to Russia.

'Beyond' Moscow Request

SAS seeks "beyond" Moscow rights as a first step toward another polar route to the Far East. One estimate places the mileage savings gained by using the trans-Siberian route between London and Tokyo at 3,500 mi. as compared to the distance airlines are forced to fly on the ancient trade route via India because of Iron Curtain restrictions.

How far the Soviet Union will go in making bilateral concessions in order to fulfill its long range program is still a matter of conjecture. During the Stalin regime, no commercial flights operated by either Communist or western nations were allowed within Russia proper.

In early 1955, agreements were made with a number of satellite countries as a first step in the development of Soviet commercial airpower. First agreement with a nation outside the Communist sphere of influence was with Sweden.

It now appears evident that Russia has no intention of being left behind in air transportation progress and, backed by an impressive fleet of modern turbine-powered transports is making a serious bid for a prestige ranking in commercial aviation.

1958 Objectives

Completion of bilateral agreements with India and the United Kingdom now leaves only Paris and Amsterdam as major 1958 objectives in Aeroflot's expansion. Air France is cooperating with Aeroflot on an interline agreement providing for direct connections between the two carriers at Prague on the Paris-Moscow route. However, negotiations between France and Russia covering bilateral agreements have failed on at least two occasions.

The Soviets will begin talks with the U. S. on a bilateral agreement this fall. First inkling that Russia was interested in upcoming negotiations arose as part of a cultural exchange agreement designed to improve mutual understandings (AW Feb. 3, p. 47). The Soviet Union and the U. S. agreed "in principle on the establishment of reciprocal direct air flights between the U. S. and the Soviet Union."

Most observers feel that Russia has timed the talks to coincide with the availability of the long-range Tu-114 turboprop transports (AW Feb. 17, p. 38). In addition, it is believed that the Soviets want to undergo a trial-run experience of about six months with the British agreement as a basis for bargaining with the U. S.

The British agreement with the Soviet Union does not differ materially from that signed with Sweden. The pattern is substantially the same.

It is Soviet practice to negotiate directly with the government involved on principles of the agreement. All matters pertaining to technical requirements and commercial problems are then negotiated between the two airlines designated for the route or routes.

Aeroflot, however, is a part of the government. Full title of the airline is the Civil Air Fleet of the Council of Ministers of the USSR. Head of the organization's central board is Chief Air Marshal Pavel Zhigarev.

Negotiations for the U. S. will be conducted by the State Department without Pan American World Airways, the only U. S. carrier certificated to operate into Moscow, taking an active part.

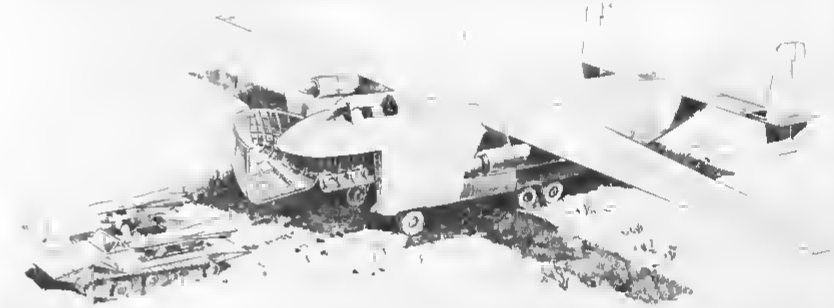
Firm Stand

In recent months, the State Department has taken a firm stand on U. S. rights in negotiations with other countries. The stand has partially offset earlier industry charges that State has been overly generous in granting traffic rights to foreign carriers. In addition, the State Department has indicated that it will make no major deviations from standard practices in dealing with the Russians and will work closely with the U. S. carriers before reaching any final decisions.

Industry officials probably will show more concern over airworthiness and navigation standards than on any point in dealing with the Russians. Latest ICAO code spells out a broad but objective set of standards for airworthiness of aircraft and then permits member nations to establish detailed standards within the code as a basis for certification of aircraft.

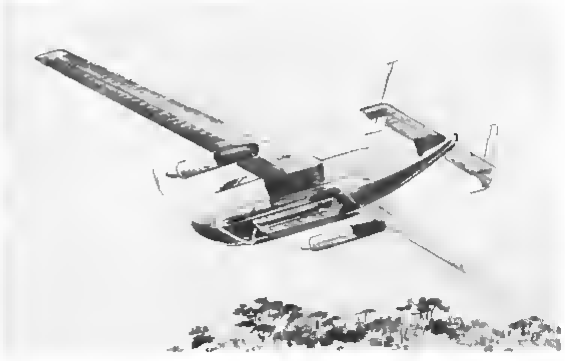
As a result, each member nation is in a position to familiarize itself with the airworthiness requirements of aircraft operated by other member nations. Some U. S. airline officials fear that there will be no method of measuring the safety factor of Soviet aircraft so long as the country remains outside of ICAO membership even though there are no inspection systems within ICAO to police airworthiness.

The British agreement does state that standards, procedures and codes established or recommended by ICAO shall be adopted. It also requires that aircraft shall be equipped to use ILS and one or more navigational aids with appropriate radio frequencies for com-



Plane to Carry Armed SAC Crew Rescue Vehicle

New type of short field takeoff and landing aircraft required to execute the Air Force escape and evasion mission is shown in drawings. Plane is designed to rescue Strategic Air Command bomber crews who are forced to bail out over enemy territory. Currently USAF has only C-47s and C-123s for this mission. New design concepts involve turboprop powerplants with rocket assist for short takeoff and bogie landing gear for use on rough or unimproved fields. Specially designed lightweight mobile weapons carrier is hauled in plane. Vehicle can fire rockets or small nuclear weapons to disperse enemy forces. Helicopters are not regarded as practical for this operation because of the relatively long distances inside enemy territory from which SAC crews may have to be rescued.



munications and approach procedures.

Moscow airport is equipped with CCA and ILS facilities, although the latter are operated on a frequency incompatible with ICAO standard equipment. Russians are reported to have agreed to a change in the ILS frequency. They also plan to construct an alternate airport at Velikiye Luki midway between Riga and Moscow in compliance with a British request.

Provision that Russian will be spoken in Russian territory for airways communication and English in United Kingdom territory came as a surprise to most observers. Since English has been accepted as the universal language by ICAO for air traffic control and navigation purposes, the U. S. will strongly resist any attempt to deviate from the standard.

Pact Differences

The bilateral agreement with Sweden calls for either English or Swedish to be spoken on Swedish airways traffic control and either Russian or English in the Soviet zones. Here are a few of the other differences between the British and Swedish agreements:

- **British agreement calls for the exchange of traffic statistics.** The Swedish agreement does not.
- **British agreement requires that frequency and scheduling of services and types of aircraft operated are agreed upon by the airlines on the basis of the "principle of fair and equal opportunity."** The Swedish agreement omits such a provision. Aeroflot will operate the Tu-104. BEA the Vickers Viscount.
- **British agreement specifies that noise suppressing devices be used to meet an acceptable noise level.** No mention of noise is made in the Swedish agreement.
- **British agreement** can be terminated six months after notice of termination by either party. The Swedish agreement carries a 12 months termination clause.

Russia's introduction of the Tu-104 to the U. S. follows a similar pattern set in England prior to the signing of the bilateral agreement. Khrushchev and Premier Nikolai Bulganin were flown to England in the Tu-104 and later the Bolshoi ballet was brought into England on the jet. The Tu-104 was used to transport the Russian United Nations delegation to the U. S. last fall, and last month it flew Ambassador Mikhail Menshikov to Baltimore Friendship Airport. Now the Russians are making a serious bid to fly the Bolshoi ballet here in the Tu-104.

Russia has admitted that the cost of operation of the Tu-104 is high and that it is not entirely suitable for long range service. However, it has repeatedly stressed that it is the first turbojet transport to operate over a scheduled route with success.

Aeroflot, however, plans to make a big impact with its turboprops as propaganda vehicles. Chief Air Marshall Zhigarev has said that two of the three new turboprop transports will be in service this year. He said that Aeroflot will offer regular service with both the 75- and 100-passenger versions of the Ilyushin Il-18 Moskva and later this fall with the Tu-114 Rossiya turboprop transports.

Very little has been said in the Soviet press about the once-highly praised Antonov An-10 Ukraina turboprop, an indication that the Russians may be running into difficulty with this model. Zhigarev said late last year that the An-10 would be ready for service "soon" but the Ukraina's rivals have been getting far more and better publicity.

The Ukraina has been flying for well over a year and has required an unusually long test period by Russian standards before being readied for scheduled service. The twin-engine An-4, predecessor of the Ukraina, was a disappointment and the Antonov design team can ill-afford another blow to its reputation. The Il-18 has made more than 50 test flights and logged over 100 hours in the air.

Russia has recently shown an increasing interest in ICAO. Although the country has made no bid for membership in either ICAO or IATA, Russian technicians are beginning to appear at meetings as observers with greater frequency.

Czechoslovakia, which has stopped making contributions to ICAO on grounds that members were sabotaging its international traffic, has resumed payments and is paying up on arrears.

CAA Asks for 'Positive Data' To Speed Jet Airport Planning

Washington—Civil Aeronautics Administration has called upon both industry and government for more "positive data" to facilitate airport planning for jet transport operations.

In its third progress report on jet age planning, the CAA brought out new data covering future jet operations for airport operators but warned that most information is estimated since manufacturers' and CAA tests have not been completed. It added that the effect of noise suppressors and other devices may require further changes in operating values.

Change in Requirements

CAA noted these changes in airport requirements for jets since the agency's last progress report was issued in July, 1957:

- **Temperatures of bituminous concrete** at which erosion from blast might be expected vary from 300F to 400F. Tar concrete and asphaltic concrete fall into a lower range while tar rubber concrete erosion temperature was in excess of 400F.
- **Runway pavements 150 ft.** wide and taxi strips 75 ft. wide will be adequate for proposed jet transports. Shoulder areas should be treated for a lateral distance of 25 ft. to prevent ingestion of foreign objects into turbines.
- **High capacity suction type** pavement sweepers are recommended to keep runways and taxi strips clear of debris and litter.
- **Fixed services** on airport aprons to replace services now provided to aircraft by mobile equipment are recommended as a means of expediting ground handling of aircraft. CAA suggested such fixed service items as: either pits or hydrants for fueling facilities, electrical ground power installations, telephone service at each gate position, compressed air for starting aircraft, air conditioning units and aircraft sewage disposal facilities.

Research Plan

In its progress report, the CAA also called for a long-range research program designed to lower the noise level of jet aircraft. It said the National Advisory Committee for Aeronautics is being asked to increase the scope of its present research program covering jet noise generation and reduction.

In this connection, the CAA called for increase in studies of jet engine intake noise. The agency said that such a program has necessarily been given a lower priority than that for exhaust noise suppression and added:

"It would seem, however, that the higher frequency and directive character of intake noise plus the lower flow rates and temperature at the intake should permit an easier solution to reduction of intake noise."

CAA said characteristics of turbine aircraft will not create radically new problems for the meteorologist but warned that "the safe and efficient operation of the number of aircraft involved will call for improved meteorological service for all phase of aircraft operations."

The agency reported that jet aircraft will require an additional emphasis on terminal forecasting and that every effort must be made to improve its accuracy. It said that this requirement is likely to result in an increase in forecasting staffs so that more individual attention can be given to each terminal.

Florida Traffic Recovering From Slump

By Glenn Garrison

New York—Airlines serving normally lush Florida routes are hoping to recoup at least some of the business lost during a disappointing beginning of their peak winter season.

Unusually cold weather in the resort area hit Florida hard, but bookings have picked up during the past few weeks and airline traffic now is running ahead of last year's. The economic recession is another factor but is not generally considered a major one in the Florida picture.

Results of the first three months of the season—December, January and February—have been spotty, with February traffic the low point. Christmas holiday business was good. Airlines hope the peak season will run later this year instead of tapering off around the middle of April. But nobody expects to gain back all the anticipated business which failed to materialize.

Eastern Air Lines' preliminary figures for the three months show a drop of 6.4% in traffic to Florida from the same 1956-57 period. Eastern carried 445,810 passengers into Florida during the later period, down from 475,708 passengers.

The carrier's Florida business was up 9.7% in December over the previous year. January traffic was off 2.7% and in February traffic dropped 19.7% from February, 1957.

Eastern's advance bookings to Florida this season were ahead of last year's until the cancellations started coming in. The airline attributes part of the trouble to publicity given the cold spells, which it says helped change the minds of a number of people. Eastern is offering about the same number of seats as last year into Miami, some 6,200 in its DC-7Bs, DC-6Bs, Super Constellations, Super C Constellations and leased equipment.

Eastern's only major scheduling changes from original plans for the season were to take two 93-passenger DC-7B coaches off daily round-trip schedules from O'Hare Field, Chicago, to Miami and run the service Friday, Saturday and Sunday southbound and Saturday, Sunday and Monday northbound, and to add two DC-7B round-trip coach schedules at New York. These adjustments took place March 1.

Carrier is experiencing good March business and expects a good April, but these are normally good months and can hardly be expected to make up entirely for the earlier losses.

National Airlines paints the most cheerful picture of seasonal business so far, but admits traffic has been under expectations. National has increased its capacity from New York to Florida about 20% this year to a total of about 1,200 seats daily out of New York. Airline reports the best December results yet, January somewhat better than last year, February off, March better again.

February load factor for the system was 55.7% off about 9% from the previous February figure. Out of New York, on the other hand, National says its February load factor showed a 9% improvement.

For the first 18 days of March, National's load factor out of New York to Florida was 9% better than last March, the airline reports.

Delta Air Lines, with high hopes for an excellent season on its route from Chicago to Florida, started out with expanded schedule plans and was forced to change some of them. As of Feb. 1, Delta had its peak capacity, 12 flights from Chicago Midway Airport and four flights from O'Hare. This is the first season Delta has gone into O'Hare, scheduling nonstop flights to Miami from that airport in anticipation of expanded business.

But weather and general business conditions "piled up" in February, according to Delta. As of April 1, the airline plans to run nine flights from Midway and two from O'Hare in its DC-7Bs, DC-7s and DC-6s. Peak had originally been planned up to April 26.

Traffic now, however, is better than it was at this time last year on Delta's Florida runs. The airline is intensifying its sales promotion of summer Florida business, has campaigns now under way in Chicago and Cincinnati.

Northeast Airlines could hardly have encountered worse breaks for its first full season on the fiercely competitive runs between Florida and the northeast. Stepping into a major league where the play is not always gentle, the airline began its Florida operation in January, 1957, and within a few weeks suffered the major disaster of a fatal crash on Rikers Island, N. Y., following takeoff of a fully loaded, leased DC-6A (AW March 17, p. 29). Some of the airline's people believe this negative advertising has been the hardest single obstacle to overcome. A further handicap has been the lack of equipment for first class service, the expected deliveries of Bristol Britannias having been postponed and currently problematical.

Northeast uses its fleet of 10 new DC-6Bs, the last of which was delivered last Oct. 30, entirely in coach service. Thinking is that the 76-passenger airplane can serve competitively as coach equipment but would be at a disadvantage over later aircraft as a first class operator.

Finally, of course, Northeast had the bad luck to run into the abnormal Florida season on its first full scale commitment to the market.

The airline's annual report cites "the coldest winter in Florida history" and a business recession beginning in September as two reasons why Florida traffic has fallen short of expectations. To date, Northeast has carried about 175,000 passengers into and out of Florida.

Northeast has no real basis for comparing this season with last season because the first months of Florida service in 1957 were more or less a token service. Last January the carrier's Florida traffic totaled less than 1,000 passengers. Last February's total was about 2,000.

Northeast is now offering about 2,000 seats a day in both directions between Florida and its northern points Philadelphia business the airline says, is proving better proportionately than either Boston or New York. Northeast now schedules seven flights daily out of Boston—one of which is nonstop to Miami, with the others serving Philadelphia, New York or Washington—and five New York-originating flights for a total of 12 schedules.

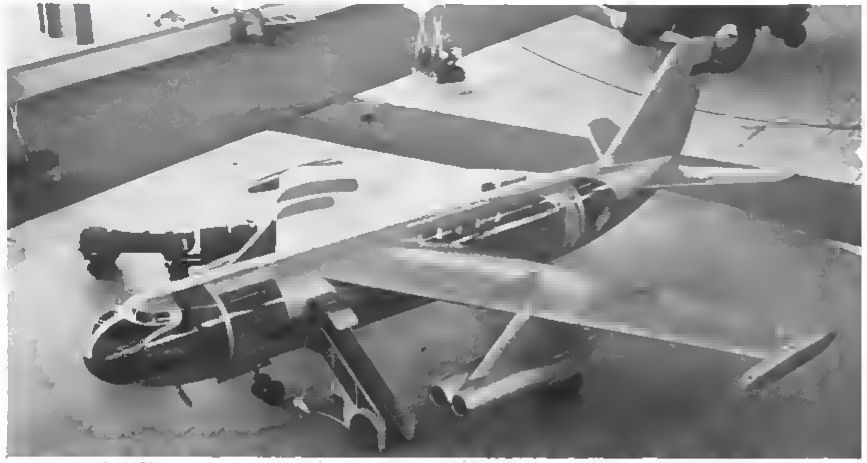
The airline is planning to rework its entire scheduling pattern to increase utilization and frequencies. It is launching an intensive promotional campaign to step up southbound traffic, which is proving much lighter than northbound and to make a strong bid for summer business. First stage of the campaign is aimed at travel agents throughout the system.

Long range plans include a sales effort to increase business travel on the route in the hope of balancing out pleasure and business customers.

Northeast lost about $4 million last year, of which $2 million was in its New England operation, formerly compensated by subsidy. The carrier spent about $1.5 million advertising and promoting its new routes.

The airline carried 592,967 passengers in 1956 and grossed $8,138,375 in revenues, last year the totals were 763,617 passengers and $13,164,475 in revenue.

Gloomy summation of this year's Florida season is offered by a leading travel agent who handles a large volume of business to the area. Final result, he predicts, will be about 30% off last year's. The first three months of the season, according to the agent, were 40-50% poorer than that period of last year. It was strictly due to the weather and there was an immediate pickup when the weather improved, he reports.



CUTAWAY model of 72-seat East German BB-152 jet transport reveals cabin and flight deck seating arrangement, cabin decorating scheme.

East Germans Display BB-152 Mockups

Leipzig—First official details of the East German BB-152 jet transport and its Type 014 powerplants have been shown here in the Technical Section of the annual Leipzig Trade Fair.

A tenth-scale model of the four-jet airliner, designed by former German Prof. Brunolf Baade, was shown together with a full-size mockup or model of the engine (AW Mar. 17, p. 30).

The 72-seat transport prototype is scheduled to fly in May and to enter service with the East German Deutsche Lufthansa in 1960. Proposed routes will be Berlin-Moscow and Berlin-Sofia now being flown by Russian-designed Ilyushin 14Ps.

Gross weight of the transport is 102,000 lb., and its payload is given as about 12,000 lb. Maximum stage length is 1,800 mi.

Model shows a conventional swept wing layout with four engines mounted in paired pods. Boundary-layer fences are positioned on either side of the pod. Shape of the rear portion of the nacelle includes a bulge for housing the main landing gear bogies. Engines exhaust on either side of this housing.

Baade's design does not have very refined lines, and the quoted cruise speed of 500 to 530 mph. seems optimistic in view of the extremely blunt fuselage nose, the moderate wing sweep and high thickness-chord ratio.

Cabin interior is decorated with pale blue ceilings and walls, darker blue chairs with textured fabrics and deep blue rugs. Window curtains are a light brown. Viscount-type windows appear in one view of the mockup with a handgrip at the top for pulling out the entire unit for emergency escape.

Seating appears to be five-abreast for tourist, with the usual two seats on one side of the aisle. Flight deck shows position for a radio operator and possibly a flight engineer, in addition to the pilot and copilot.

Wing span of the BB-152 is 88 ft., overall length is 103 ft., and height is just under 30 ft. Wing area is 1,470 sq. ft.

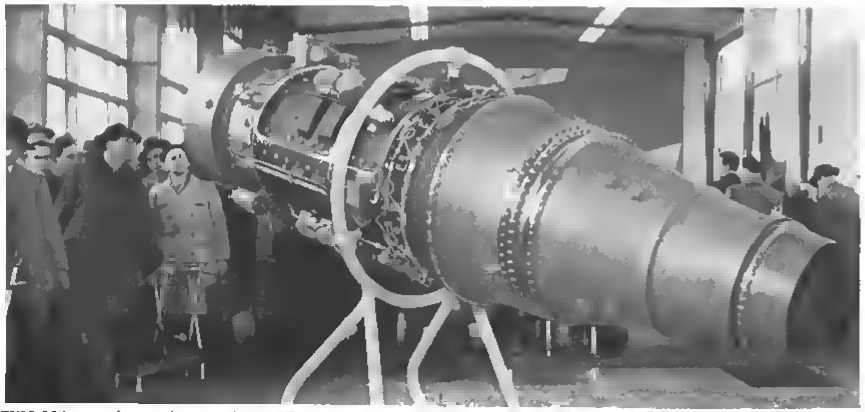
Takeoff run is given as 3,200 ft., landing speed as 120 mph. Cabin is pressurized to 6,400 ft. at cruise altitudes.

Thrust of the Type 014 powerplant is 6,950 lb. The engine has a 12-stage axial compressor, a cannular combustion chamber with 12 individual burners and a two-stage turbine. Observers with long memories remembered the German wartime Junkers Jumo series of jet engines, which included a Type 014 project of similar description.

Fuel consumption of the engine, presumably under cruise conditions, is given as 0.85 lb./lb./hr. Mass air flow is 110.25 lb./sec. Engine overall length is 161.42 in., and diameter is 38.58 in.

Both engine and airplane are presented as native products without Russian influence, and the pictures tend to back up that claim. There is none of the design sophistication of the latest Russian developments showing in the East German products.

East Germany's aircraft industry (Volkseigene Luftfahrtindustrie der Deutschen Demokratischen Republik—which translates as the People's Government Aircraft Industry of the German Democratic Republic) branched out just about four years ago and started to produce Ilyushin Il 14 twin-engined transports under license. Factory is the Industriewerk at Dresden, presumably now building the BB-152 prototypes.



TYPE 014 powerplant mockup has 12-stage axial compressor, cannular combustion chamber with 12 individual burners, two-stage turbine.

Communication Plans Requested by AMB

Washington—Airways Modernization Board has asked for industry proposals by April 30 for development of a two-way automatic ground/air/ground communication system (AGACS), or data link, to be ready for experimental flight tests by July 1, 1959.

Specifications for the new data link, which will enable traffic controllers and pilots to exchange routine messages by push button to relieve overcrowded voice communications, were released to representatives of 42 avionic companies who attended recent AMB meeting here. Indications are that a sizable number of the firms will submit proposals.

Specifications call for a data link system operating in the very high frequency (VHF) band now used for civil

AIRLINE OBSERVER

► U.S. airlines are showing increasing concern over frequency of flights scheduled this summer on North Atlantic routes and will ask the State Department to review seat capacity expected to be offered. The U.S. industry feels that much of the traffic originating in New York on such carriers as KLM, SAS and Sabena is fifth freedom traffic and is, therefore, restricted by the Bermuda agreement. Foreign carriers can be expected to argue that the traffic is not fifth freedom even though it is transported from the U.S. to a point beyond the homeland of the carrier involved. The homeland stop, they will say, is only a stop-over point or a co-terminal station and not a pick-up point.

► Aerojet-General is expected to begin flight tests shortly on its infrared proximity warning indicator fitted out with new optics. Ground tests make company officials optimistic that it can proceed with fabrication of prototype model for early airline evaluation.

► Northeast Airlines is back in the market for turbine-powered transports but has not gone beyond the looking stage. Northeast officials are watching Britannia performance closely on British Overseas Airways Corp. and El Al Israel Airlines. Vickers is making a strong bid to Northeast in an attempt to evoke some interest in the 75 Viscounts originally slated for Capital Airlines. Meanwhile Board Chairman George E. Gardner and President James W. Austin have been on the West Coast as prospective customers for a fleet of American-made turbojet transports.

► Latest Air Transport Assn. survey of no-show passengers indicates that no-shows account for about 6% of total traffic as compared with between 13 and 14% 18 months ago. Actual reduction of no-shows since the first phase of the three-part control plan was adopted in Sept., 1956 now amounts to 55.5%. According to the report, airlines are re-selling about 22% of the cancellations made within three hours of flight time.

► Air Marshall P. F. Zhigarev, head of Russia's Aeroflot airline, says the Soviet carrier will begin to take delivery on a "large number" of Mil and Kamov helicopters this year coincident with the first deliveries of new turboprop transports. The rotary wing craft will be used primarily over roadless mountainous areas and other sections of the USSR difficult to reach by surface travel or conventional aircraft.

► Dorval Air Transport, one of the largest of Canadian air freight operators, has been placed into receivership following a petition for bankruptcy filed by Imperial Oil Ltd. of Toronto.

► Formal talks between Japan and the U.S. on a revision of the bilateral agreement between the two countries will begin in mid-April. Japanese delegation is in Washington now discussing preliminary subjects pertaining to the agreement.

► Civil Aeronautics Board has approved the new "economy" service on North Atlantic routes to be effective April 1. The new rate of $252 for a flight between New York and London is $38 less than present tourist fares. Board also approved discontinuance of the present 15-day round trip excursion fares.

► Trans World Airlines has sold a fleet of six DC-4s to Eastern Aircraft Corp. of Hackensack, N.J. Mario Ferreira, co-owner of Eastern Aircraft, said he plans to use the aircraft, which were flown as cargo planes by TWA, on a newly organized airline called Aerotour which will operate in Germany. Ferreira is president of Aerotour.

► Initial runway configuration proposed for Chantilly Airport, second airport for Washington, is drawing sharp protests from airline pilots. They charge that planned north-south parallel runways are not suitable for prevalent wind conditions in the area. Pilots want dual runways set at northeast-southwest and northwest-southeast angles, a configuration that will require the purchase of additional acreage for the airport. Pilots also warn that land to be purchased under proposed runway arrangement is not sufficient for future expansion.

De Havilland 121 Jetliner Selected by BEA

British European Airways plans to order 21 de Havilland 121 jetliners with options for 12 more. Airliner, powered by three Rolls-Royce R.B. 141 engines, can haul 70-80 passengers in standard seating configuration up to 100 in high density seat plan. Maximum cruising speed will be more than 600 mph. Plane is designed to operate from 6,000-ft. runways. Engines will develop 12,000 lb. thrust.

voice communications. System is to use existing VHF communications receivers and transmitters designed to Aeronautical Radio Inc. characteristic 520A and also is to be able to operate with military ultra high frequency (UHF) receivers and transmitters.

System proposed by AMB is to be able to handle up to 500 aircraft (flying within line-of-sight range of station) and provide interchange of information at least once every two minutes.

Through ground data link stations, traffic controllers or traffic control computers will be able to transmit two types of messages addressed to a specific aircraft:

- **One of up to 32 different** routine messages, such as request for report, proceed, voice contact requested, change over to new frequency, emergency alert.
- **One of up to 32 different** messages conveying specific information, such as proceed to fix "X," hold at "Y" altitude.

Pilot's airborne data link also will enable him to transmit both types of messages, providing a choice of one of up to 32 routine messages or 32 specific information messages, the latter giving airplane position, altitude and time over the fix.

AMB is asking that system provide, if possible, one million different "addresses" to permit a specific one to be assigned to each aircraft and used without change for its lifetime.

The agency says it also would be desirable if the system permitted an emergency message to be simultaneously transmitted to all aircraft in the area without taking time for a "roll call."

Airways Modernization Board specification calls for use of techniques to assure that a message intended for one aircraft cannot be accidentally received by another. Specification also calls for airborne equipment to automatically alert the pilot whenever it fails to receive a ground-station interrogation for a period of more than five minutes.

SHORTLINES

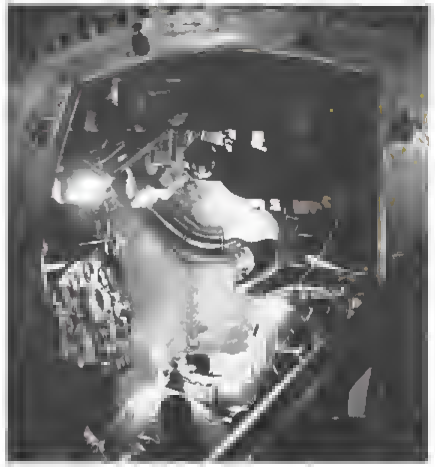
► **Air Algerie** has ordered two Sud Aviation twin-jet Caravelle transports with delivery scheduled in early 1960. The Algerian carrier operates routes between Algiers and France and Switzerland as well as within Algeria. The Air Algerie order brings to 25 the number of Caravelles sold to date with options for another 35.

► **Air France** plans three tours of the Soviet Union for 20, 25 and 32 days to include stopovers at such points as Leningrad, Moscow, Kharkov, Odessa, Yalta, Sochi on the Black Sea and Tiflis in the Caucasus. The tours will be flown on Air France to Prague with connections there on Aeroflot's new Tupolev jet aircraft to cities in the USSR.

► **Continental Air Lines**, recently recommended by Civil Aeronautics Board for new services on routes between Dallas and the West Coast, says it will serve these routes with Boeing 707 turbojets, turboprop Vickers Mark II Viscounts and Douglas DC-7Bs.

► **Swissair** carried 992,911 revenue passengers on its world network during 1957, an increase of 28% over the 1956 figure. The airline carried 13,638 tons of freight and 4,798 tons of mail with a total of 114,898,610 ton-miles flown. The average load factor was 61.5%.

► **Trans-Pacific (Aloha) Airlines** reports a net profit of $63,737 for 1957 despite an operating loss of $79,435. The loss was offset by revenues of $110,868 from the sale of one DC-3 and $50,668 from military contracts. The airline's passenger volume increased from 209,109 in 1956 to 222,804 in 1957.



NAVY says man could survive on moon in 22-lb full-pressure suit (left) designed for Navy by B. F. Goodrich Co. It has now been replaced by lighter 8-lb suit. Right, North American Aviation test pilot Scott Crossfield pilots X-15 mockup in gondola of Navy centrifuge.

Navy Details Needs for Space Mission

By Cecil Brownlow

Washington—Navy believes it needs to go to space with both manned and unmanned vehicles to do an effective job on the sea. It hopes to go there as part of a national program involving all three military services.

Primary and most immediate areas in which Navy says it has space requirements are in the fields of reconnaissance, communications relay and all-weather navigation.

Navy officials also foresee the possibility of using satellites as anti-submarine weapons, monitoring stationary sonar buoys, and as platforms for mapping ship and aircraft movements.

Bureau of Aeronautics already has conducted a hypothetical study aimed towards placing a hypersonic glider aboard a submarine as a futuristic follow-on to the Polaris fleet ballistic missile weapon system and with roughly the same advantages and problems. One of these problems, Navy officials believe, could be effectively solved by a navigation satellite.

"Artificial star" satellites they say could give the commander of a Polaris submarine a precise fix on the location of his vessel in relation to its intended target.

They also believe advanced satellites might be used to relay a firing order to the submarine commander and then, on the next orbit, tell him the result of his shot.

Such a satellite would require a world-

CROSSFIELD (left) "flies" centrifuge gondola. High G forces led to right hand console stick adaptation. At right, pilot in centrifuge gondola sags under force of six Gs.

wide tracking system to provide exact and complete data on the orbit, which Navy says it could provide through a network of mobile telemetry ships

The service already is gaining valuable space information from its north-south Minitrack system established to monitor satellite vehicles fired in connection with the International Geophysical Year and plans a similar range to extend across the Pacific from the National Pacific Missile Test Range at Pt Mugu, Calif (AW March 17, p 21)

These tracking stations will grow in importance with the appearance of reconnaissance satellites and manned or unmanned space vehicles designed to re enter the earth s atmosphere

The Minitrack stations will monitor the reconnaissance satellites, collect and reduce the data transmitted from them In modified form, they also can be used to exercise effective control over a manned or unmanned re-entry vehicle, lengthening the orbit in measured steps to gradually slow the vehicle and make re-entry possible and guarding against any human control failures

X-15 Research

North American's X-15 high-altitude research vehicle, for example, will be monitored in its initial flights early next year by Navy's inland tracking range extending from Pt Mugu to Dugway Utah, 500 mi away The X-15 will take off from the far end of the range at Dugway and follow a measured course to Edwards AFB, Calif The inland range will follow its flight reduce data on its performance and exercise some control over the aircraft in the event of serious pilot error

Navy also has been active since 1942 in attempting to solve the human factor barriers to space flight and is deeply involved in this aspect of the X-15 program

Working with the National Advisory Committee for Aeronautics, Navy has rigged the large centrifuge at its Aviation Medical Acceleration Laboratory, Johnsville, Pa , to accurately simulate the flight conditions the high-altitude aircraft will encounter The centrifuge, believed to be the world s largest, has been modified to present an exact duplication of the X-15's cockpit control placement, manual and visual, and has been extensively flown by the first three men scheduled to pilot the aircraft--North American Aviation test pilot Scott Crossfield, Air Force Capt. Iven Kincheloe and NACA test pilot Joseph Walker

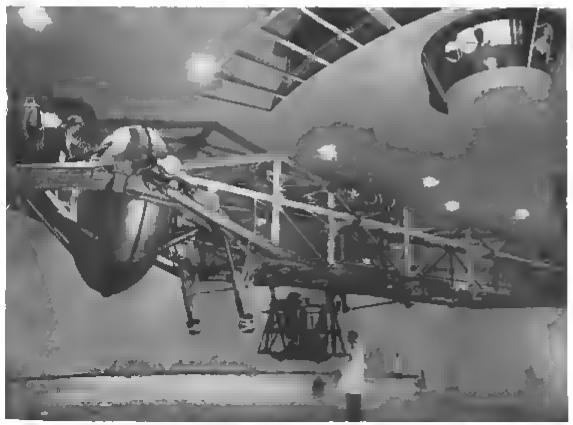
In planning for the program to study pilot capabilities and to find means of compensating for human shortcomings, engineers managed for the first time to permit the pilot to actually control the centrifuge gondola rather than simply ride as a passenger as he had in the past

The solution was found through a closed loop integration of the centrifuge with Johnsville's Typhoon analogue computer made by the Radio Corp of America

The centrifuge itself is powered by a 180 ton, 4,000 hp motor, has a 50 ft steel arm and gondola weighing a total of 84,000 lb

In its overall assault to overcome the problems of putting man safely into space, Navy is conducting

• Spatial orientation programs at Naval School of Aviation Medicine at Pensa



NAVY'S human centrifuge at Johnsville, Pa., the first rigged to afford pilot control, is believed to be the world's largest.

cola Fla., to determine and define human orientation, performance and the flight control capabilities of man in space flight

- **Bio-energetics program** and a human calorimeter at the Navy Medical Research Institute, Bethesda, Md., to determine human tolerances to the temperatures that will be encountered
- **Telemetering and recording equipment** essential for transmission of physiological responses from space to earth is under development at the Medical Research Institute, which also is studying the physiological and physiological stresses imposed in space flight
- **High pressure environment facilities** at Bethesda and at the Naval Medical Research Laboratory in New London, Conn. are attempting to determine the role high-pressure altitude can have in improving and prolonging the habitability of space flight vehicles
- **Flying Laboratory** of Navy's Project RAM—Research Aviation Medicine—is analyzing and recording physiological information under field and in flight conditions
- **Acceleration and space re-entry** programs are under way at the Aviation Medical Acceleration Laboratory in Johnsville to try and determine man's ability to withstand and perform under acceleration stresses and the human aspects of the re-entry program
- **Maintenance of artificial** atmospheres and support equipment is under development at the Air Crew Equipment Laboratory in Philadelphia. Navy claims the laboratory is the only one in the U.S. devoted primarily to this type work.

More specifically, here is a rundown of the space work now under way at Navy's four human factors centers:

Aviation Medicine School

Researchers at the Naval School of Aviation Medicine in Pensacola say initial manned space flights should be designed primarily to ensure the absolute safety of the pilot with a sharp limitation on communications, control and data collection.

First manned flights, they say, should follow a ballistic trajectory. Following steps officials add should be to put a manned vehicle into orbit for a "minimum time," then extended orbits and, finally, actual space operations.

The school terms pilot selection and training as a "critical subtask" of space flight and has established these basic parameters for a crew member—a minimum age of 30 to ensure mature judgment and emotional stability, a maximum weight of 150 lb. To gain further insight into the optimum training and selection of crew members, the school is now studying:

- **Sound and vibration effects** which could become critical at takeoff
- **Influence of rocket tumbling** on the pilot
- **Behavior of man in artificial atmospheres** and in seclusion
- **Influence of prolonged lack of gravi**tational stimuli to the homeostatic center of the brain
- **Effects of prolonged** weightlessness and artificial centrifugal gravity

Research Institute

Work being conducted at the Navy Medical Research Institute includes experiments with high and low pressure chambers to study the environment of space and biochemical laboratories to examine the chemical changes associated with physiological and psychological stresses that will be encountered in space.

The institute's toxicology laboratories are studying the types and effects of noxious agents to be found in a confined atmosphere. Its physiological data radio telemetry laboratory has developed techniques suitable for space to earth transmissions of physiological and psychological information.

Along with its piloted centrifuge now rigged for X-15 research, the Aviation Medical Acceleration Laboratory has several animal centrifuges. The centrifuge complex is used to study various complex acceleration patterns, and can give full flight simulation up to 40 Gs.

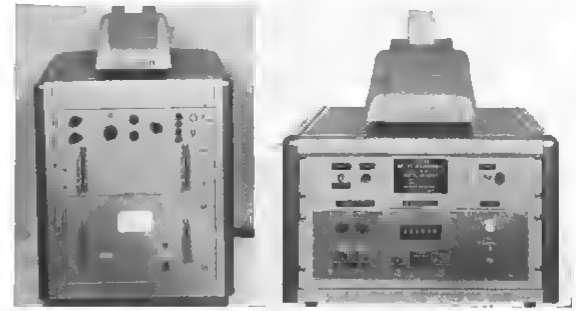
The laboratory would like to put into space, at the earliest possible time, a small animal laboratory to test the performance of a small animal undergoing an extended period of zero gravity. On the earth, zero gravity can be simulated for a few seconds at the most.

Other programs include testing and development of components, capsules, guidance systems and pilot restraint systems under acceleration.

The Air Crew Equipment Laboratory, located at the Naval Air Material Center in Philadelphia, is concentrating upon studies of extreme altitude environment habitability, space suits, capsules and accessory equipment, cockpit design, layout and data presentation, air crew escape methods, survival equipment and fatigue problems.

The laboratory is equipped with a vertical accelerator and a horizontal accelerator and has an explosive decompression chamber that can simulate altitudes of up to 100,000 ft. and temperatures from −80° to plus 180°F, provide a decompression rate of 23,000 to 60,000 in 100 milliseconds.

Laboratory officials also hope to build a mockup of a capsule to provide the necessary breathing gases and logistics for space flight plus the removal of gaseous wastes and noxious gases and provisions for ventilation and insulation.



ATLAS thrust measuring system (left) indicates and records values of thrust gimbaling and misalignment forces. Device at right records missile propellant weight.

Three Firms Build Measuring Unit

Three subcontractors were teamed to build the thrust weighing and measuring unit used for launching Convair's Atlas intercontinental ballistic missile at Cape Canaveral, Fla.

Convair itself did the design work on the release mechanism. It then subcontracted the work to Space Corp., a company which was formed last year and bought out the manufacturing activities of Shaw & Estes. Shaw & Estes now operates only in the construction business.

Space in turn subcontracted the weighing and thrust measuring unit to Gilmore Industries, Cleveland, Ohio. Gilmore bought the load cells for the Cape Canaveral units from Baldwin-Lima-Hamilton Corp.

Baldwin-Lima-Hamilton has built the entire equipment for Convair's Sycamore Canyon test site in California, but it was not responsible for the Cape Canaveral equipment—except the load cells—as AVIATION WEEK said in its Feb. 24 issue, p. 26.

The Gilmore weight and thrust measuring system is capable of indicating and recording values of missile weight, propellant weight, thrust gimbaling motor forces and thrust misalignment forces.

Forces are translated into values represented by weight and thrust, pitch moment, yaw moment, roll moment, "XX" axis side load and "YY" axis side load. The system compensates for the effect of side load with respect to wind and with respect to interacting moments. A patent is pending for the system.

Four of the Gilmore systems are installed at Cape Canaveral and three are installed at a static test site at Edwards AFB, Calif., under the same subcontracting procedure.

Besides the Edwards and Cape Canaveral installations, Space Corp. has handled installation of thrust measuring equipment for the Titan intercontinental ballistic missile static test complex at Martin-Denver.

Rocket Engine Tested on Navy Fury

Ground view of FJ-4F Fury fighter shows modification for Rocketdyne AR-1 rocket engine installation over tail pipe. Rocket uses JP-4 and hydrogen peroxide.

An breathing XSM-64, Navaho cruise missile is on Cape Canaveral, Fla., test stand, at left. Rocketdyne booster has two 135,000 lb. thrust chambers. At right, missile and booster head skyward as smoke obscures launch pad.

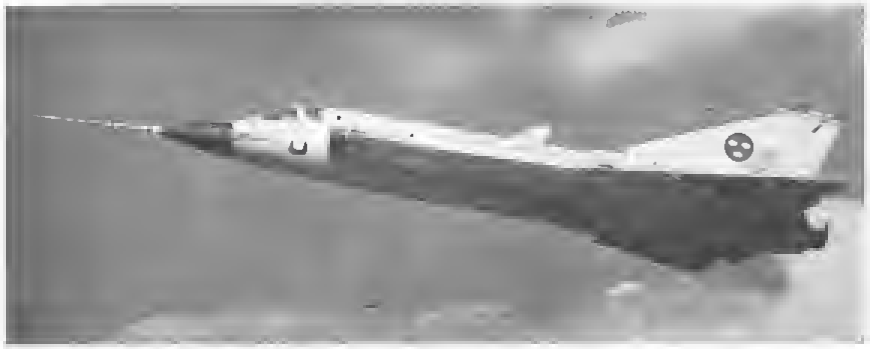
Navaho missile and its big booster near peak of sharp climb angle shortly before airframes are due to separate. XSM-64 was powered by two Wright Aeronautical Division ramjet engines.

Photos Show Navaho Firing, Separation Sequence

Navaho booster, pushing missile higher, develops 270,000 lb thrust, is called most powerful of its kind. Project has been canceled.

Long range picture shows start of separation of rocket booster. Below, booster tumbles, burning in midsection.

Last Navaho missile at end of test program was destroyed when ramjet engine experienced premature cutoff. Cape Canaveral range safety officer destroyed weapon over Atlantic Ocean.



PROTOTYPE Saab J35 Draken has flown at Mach 1 4, can go supersonic in climb Tail pipe is partly visible on this model

All-Swedish J35 Aims at Mach 2 Speeds

By David A. Anderton

Linköping, Sweden—First production Saab J35 Draken all-weather fighter has been delivered to the Royal Swedish Air Force

In a year, first squadrons of the supersonic single-seater are expected to become operational, replacing the Saab J29 "Flying Barrels" now constituting the majority of Sweden's combat air force.

Further development of the Draken with Mach 2 performance and air-to-air missiles should become an operational weapon in the early 1960s.

Prototype Drakens, powered by a single Swedish-built Rolls-Royce Avon 200 turbojet with Rolls-Royce afterburner, have been flying at Mach 1 4 in high speed tests. Production airplanes, using the same engine but with a Swedish afterburner making full use of the Avon's potential, will have top speeds around Mach 1 8.

Swedish radar equipment will be installed in production deliveries to give the single-seat airplane all-weather capability. First airplanes off the line will have night-fighting capability only.

All-Swedish Plane

With the exception of a few accessories and components such as its Goodyear wheels and brakes from America, the Draken is an all Swedish airplane, the product of first class engineering and technical talent and of close cooperation between the Saab Aircraft Co and the Royal Swedish Air Force and Air Board.

This exclusive AVIATION WEEK story on the double delta Draken is the first detailed engineering analysis of the J35's design development, flight test program and production.

The Draken (Dragon) is a relatively small airplane, dimensionally comparable to the Douglas F4D Skyray series, and probably also comparable in performance. Both planes have engines in the basic 10,000-lb thrust category. Both are relatively light and both look about equivalent on drag.

Overall length of the Draken is 46 5 ft and the wingspan is 30 8 ft. Depending on armament, gross weight is between 18,000 and 20,000 lb. Area of the double delta wing is 538 sq. ft. wing aspect ratio is 1 77. Leading edge sweep on the center wing is 80 deg., and on the outer wing panels is 57 deg.

Powerplant is built in Sweden under license by Svenska Flygmotor. Designated RM 6 by the Swedish air force, the engine is a Rolls-Royce Avon 200 series design probably equivalent to the RA 24, two of which power the English Electric P 1B. Dry rating of the RA 24 engine is 11,250 lb. thrust, a type-test figure. With a Rolls-Royce afterburner this static figure increases to about 14 500 lb. These engines were installed in the prototype airplanes; production craft will have the same basic engine but with a full afterburner developed by engineers of the Air Board and Svenska Flymotor. Thrust with afterburning will approximate 15 800 lb.

Complete airborne radar gear will be installed, including a nose scanner for search and a scope for presentation of search and other target data to the pilot. Fire-control radar will also be fitted. Standard armament configuration will be a pair of air-to-air missiles or two pods containing unguided air-to-air rockets. A pair of 30 mm. revolver cannon are mounted to fire inboard of the break in the wing leading edge.

Configuration Close-Up

The fuselage is in two major sections, joined by a bolted flange connection. Forward section includes the forward wing roots, cockpit, duct inlets, nose gear, some integral fuel tanks and equipment. The rear section includes rear wing roots, main landing gear, powerplant, bag type fuel tanks, armament and equipment. This is the major structural heart of the airplane, and once assembled, the only remaining structural components are two small wing outer panels and the vertical surface. Trailing edge of entire wing is blunt, starting at the tip with only the double skin thickness and increasing progressively inboard to a total thickness of about two and one-half inches at the root.

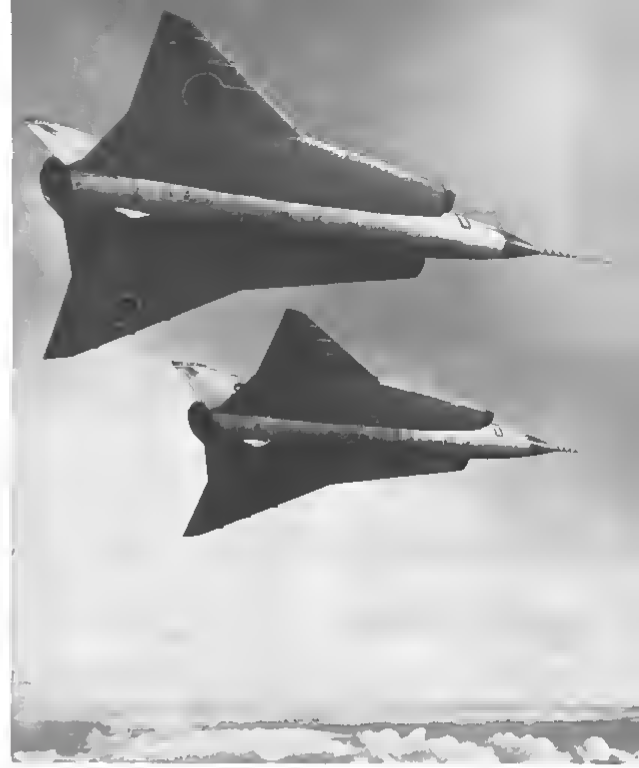
The control surfaces for pitch and roll are at the wing trailing edge, and are in three segments—one inboard, two outboard. All three surfaces are deflected simultaneously, with differential deflections being used to combine roll with pitch. There is no flap; tests on the Saab 210 research plane proved there was no need for the surface.

Four petal speed brakes are mounted on the fuselage just ahead of the plane of the control hinge line.

Two tandem hydraulic jacks operate each surface; they are fed by two separate hydraulic systems so that if one is knocked out in combat the other will get the pilot home. None of the aerodynamic hinge moment gets back to the stick or rudder pedals, instead, stick forces are artificially generated and are fed back to the pilot by a system that senses Mach number and dynamic pressure (Q").

Cowl lips are not sharp, although their radius of curvature is quite small. They are separated from the fuselage by

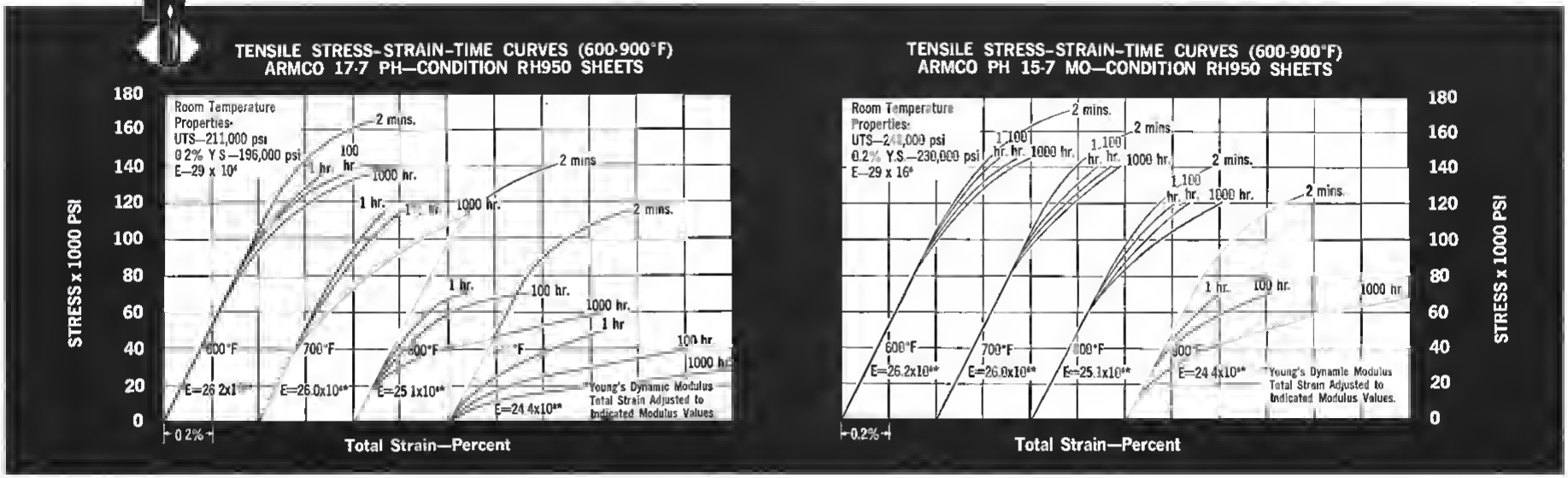
STRUCTURAL changes in first production model of J35 Draken include major cockpit modification. Tail pipe has been enclosed and VHF antenna is installed on belly. "U" designation denotes aircraft is undergoing experimental flight test.



DOUBLE-DELTA configuration and tail cone forward sweep is shown in this prototype formation picture. Fences under delta wings reduce buffeting and give stability augmentation. Cambered surface tests may eliminate the fences.

CLUSTER of 12 Bofors rockets, six under each wing, can be carried on Draken. This version is 13.5 cm. air-to-ground type. Inboard fence is at upper left.

Stress-Strain-Time Curves Illustrate Major Advantages of Armco PH 15-7 Mo and 17-7 PH in Missile and Aircraft Design



Show high resistance to creep offered by special Armco Stainless Steels, provide useful evaluation and design data

These stress-strain-time, or isochronous creep curves, not only provide designers with needed data but point out one of the major advantages of PH 15-7 Mo and 17-7 PH—their exceptional creep strength in the range of 600 to 900 F.

In addition to these data, which show deformation at operating stress, time and temperature, extensive design information is available on other properties of both PH 15-7 Mo and 17-7 PH. This includes basic tensile and compressive properties, elevated temperature stress-strain curves, tangent and secant moduli and much other pertinent data.

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Exclusive Series

Aviation Week, with this article, begins a two part series on Sweden's Saab J35 Draken supersonic interceptor. David A. Anderton, Aviation Week's European editor, is the first technical editor to see the airplane in any detail and is the first to write an on-the-spot report of what he saw. Next week, Part II will include an exclusive series of production photographs of the aircraft.

minimum dimension of about two inches. The inlet duct system has an internal bulge that improves flow distribution at the engine face.

The J35 generally behaves like any contemporary fighter aircraft with high supersonic performance. There are some detail differences: the prototypes have been flown without stability augmentation, although a pitch damper on the autopilot circuit will be installed in production airplanes. So far there has been no need for a yaw damper, although this could be a later addition also.

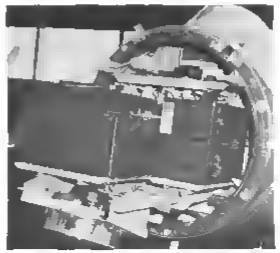
Center of gravity position is not defined in terms of per cent of chord for the J35. Usual procedure is to keep it as far aft as possible; normal position is just behind the leading-edge break in wing planform.

Normal travel of the CG during one flight is a maximum of four inches. For different load alternatives a travel of about one foot is possible.

The only flight restriction on the airplane is in the case of the rolling pullout, where the roll rate is still kept to a lower value than possible because theoretical calculations still are incomplete.

Stalling behavior is a little different, after the stall at extremely high angle of attack, the J35 will trim at a high angle of attack in a stable attitude. If the angle is further increased the plane becomes unstable and then stable again.

Ground effect on a delta with such



FLIGHT test measurements are recorded by two Hellard oscillographs which are installed in Draken radar nose section.

a low aspect ratio is very high and therefore the deceleration is high before and after touchdown. Like some other deltas, the Draken, as mentioned earlier, has no flaps.

Normal flight routine is to use afterburner from the start of takeoff until the Draken is well up and away. Operational pilots should be able to get off the ground in about 1,650 to 2,000 ft at takeoff speeds between 150 and 175 mph. An experienced Draken pilot can reduce that run to 1,500 ft.

Climb and Maneuvering

Initial rate of climb is on the order of 30,000 to 40,000 fpm. Rate of roll is tremendous because of the airplane's small span, 200 to 225 deg. per second is the normal rate used by Saab pilots.

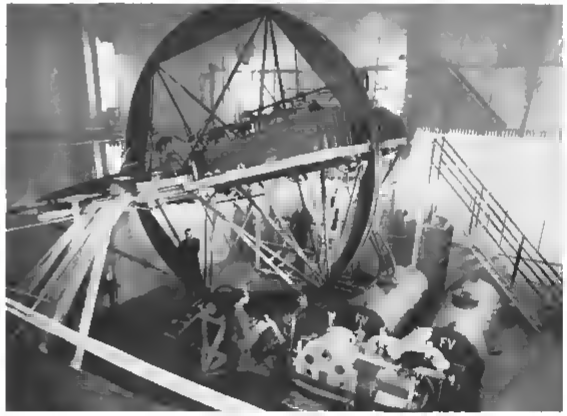
With the thin wing of the Draken there is little trim change in the transonic speed range. Beyond that the plane will accelerate rapidly to its maximum Mach number.

Prototypes powered by the Avon 200 with a Rolls Royce afterburner can hit Mach 1.4 now, but the Swedish full afterburner in production airplanes will boost that figure to about Mach 1.8.

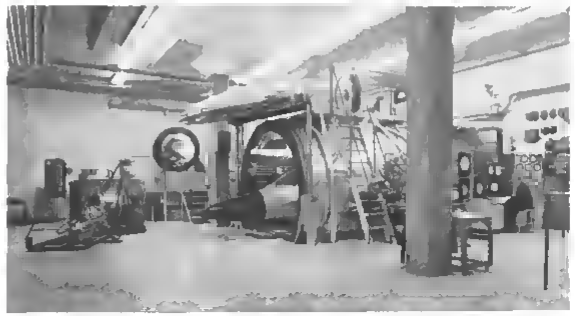
Approach speed is about 200 mph. The airplane is trimmed for a landing incidence of 12 to 14 deg. Touchdown is at about 137 mph, and the normal landing roll without brake parachute with moderate braking is about 2,000 ft.

The landing roll can be greatly reduced. On a dry concrete runway, Saab pilots have come to a stop within 1,400 ft of the touchdown point. Operational pilots are expected to be able to land in less than 2,000 ft.

Operational airplanes will have a



FUEL distribution and flow is tested on this wheel. Device is in vertical plane through thrust axis; flight direction would be from left to right in picture.



DRAKEN climate chamber takes nose section and forward fuselage, can simulate altitude and temperature extremes. Radome shape shown above will be on production J35s.

brake parachute to keep the landing run low

Landings after abnormally high approach speeds formed one part of development flight testing Pilots brought the Draken in over the fence at 195 mph, touched down at 160 mph, instead of the usual figure of less than 140 mph. On touchdown they popped the chute, slammed on full brakes and came to a grinding halt less than 2,800 ft from the fence This is indicative of field performance under combat conditions

Flight Testing

More than 700 flights have been racked up to date on the three prototype aircraft, now recently joined by the first production plane Before these, the aerodynamically similar Saab 210 had made about 1,000 flights in the low speed regime to check the expected flight characteristics of the double-delta wingform

Flight of the first prototype Draken was Oct 25, 1955, and the second followed it into the air shortly after First production airplane flew Feb 15 this year

First prototype flew supersonically without afterburner for the first time on Jan 26 1956. Two months later during flight tests it went supersonic in a climb

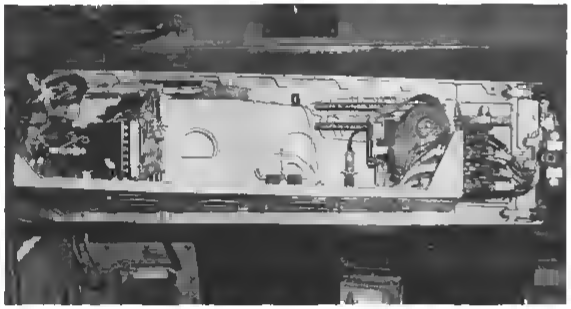
Normally the third prototype goes immediately to the Royal Swedish Air Force for evaluation tests, so that the company has been doing most of its flying with two prototypes The third currently is undergoing the rigors of winter operations at Lulea, Sweden's farthest north permanent air base just below the Arctic Circle

Most of Saab's 10 test pilots under Bengt Olow, chief of flight test, have checked out in the J35 Six of these are rated as engineering test pilots, including Olow

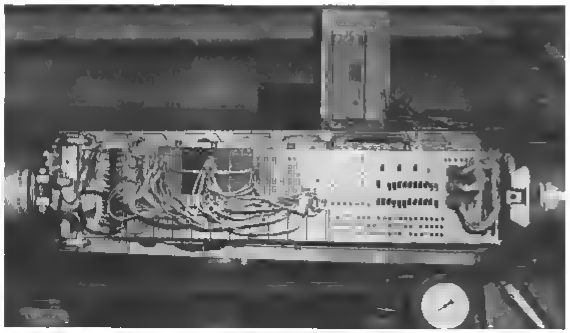
Flight test data is recorded photographically and electronically with oscillographs and camera recorders Telemetering has not yet been used, but the subject is a hot one in engineering discussions now

Flight test instrumentation is half bought and half built at Saab for special purposes

One example of aerodynamic fixing brought out by early flight tests is the



MEASUREMENT centers use port and starboard armament bays (top and bottom). Pilot can switch from one type of program to another during flight to utilize time to utmost.



Progress in Propulsion at Marquardt

by Roy E. Marquardt, President

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The Bomarc application is only one of the many propulsion projects now underway at Marquardt Currently under development are several advanced supersonic ramjet engines for application on future weapon systems

Other activities are advancing man's knowledge of hypersonic propulsion, special high energy fuels, and Aircraft Nuclear Propulsion

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Roy E. Marquardt

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fence installation on the delta wings. These fences give more stability augmentation and reduce buffeting considerably.

Cambered leading edges another trick in the aerodynamicist's bag, are under test on a prototype Draken. Outer panels have been built and should be ready for installation and flight about now, following the complete overhaul of the two company-operated prototypes during the bad-weather period that Sweden suffers early each year.

Saab engineers expect a 10-15% improvement in the lift/drag ratio with the cambered wing. This order-of-magnitude improvement has shown up in the Convair F-102A with a similar wing fix. They also expect to eliminate the wing fences with the cambered surface.

Draken Design Details

The double-delta configuration of the Draken is its most unusual and recognizable feature. There were good aerodynamic reasons for the choice, and they stemmed from a series of theoretical calculations done by the design team under Erik Bratt, chief designer for the J35.

Requirements originated during the two year period 1949-51 as a follow on for Saab's J29 "Flying Barrel" interceptor. Basic design goal was to produce an interceptor capable of knocking down some-speed jet bombers. The Swedes, who live somewhat closer to Russian boundaries than the Americans, believed it probable that the Soviets then were operating near-sonic light jet bombers. This was knowledge that took a longer time to be officially appreciated in the United States.

By 1952 the engine had been selected—it was to be a Rolls-Royce 200 series built under license in Sweden by Svenska Flygmotor. The design team began the routine of making more detailed layouts, setting equipment and pilot in place.

Four men started the preliminary design of the Draken: Bratt, who is an engineer and a pilot; one mathematician; and two aerodynamicists—one a supersonic specialist and the other a subsonic specialist.

Flight envelope for the proposed interceptor cut through Mach 1 at low altitude, and continued to increase in speed to a maximum at 36,000 ft. Above this level the speed dropped off to where the limitation of engine, inlet and airplane set the minimum value. From there down to sea level it followed the usual curved line between altitude and sea level stall.

Wing area and span are affected by altitude requirements as well as by minimum and maximum. A series of aerodynamic calculations taking these

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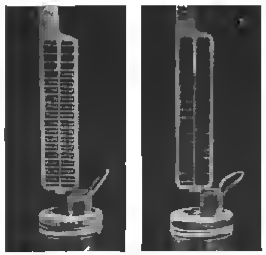

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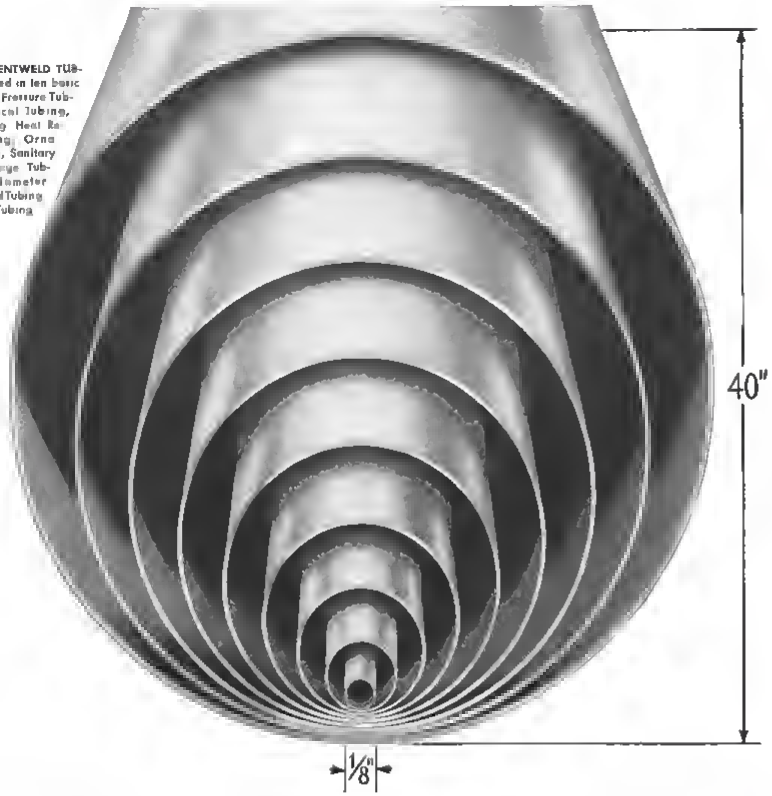

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Liquid Oxygen Tank for Thor

This liquid oxygen storage tank, part of the Thor ground support complex, is shown on its way from the manufacturing plant of Cambridge Corp., in Lowell, Mass., to Hanscom AFB, Bedford, Mass. From there, the tank was to be flown to Cooke AFB, Calif. Designed to hold 13,500 gal. of liquid oxygen at —297.4F, the tank is 50 ft. long and 8 ft. high. Built along the lines of a Thermos bottle, it consists of an inner tank of stainless steel and an outer tank of aluminum. The space between the tanks is a vacuum and serves to insulate the liquid oxygen. The tank weighs 32,000 lb. empty and over 200,000 lb. full. Its own wheels give the unit on-site mobility. Cambridge Corp., a wholly-owned subsidiary of Carrier Corp., builds similar equipment for Atlas, Jupiter and Redstone missiles.

factors into account gave a wing area that was too big and had to be cut down. The Saab aerodynamicists didn't want to reduce the span because of the reduction in ceiling that would follow. They had already selected a delta as a result of equipment and layout considerations, so the only thing to do was to chop area out of the delta geometry. This could best be done at the leading edge.

But such cutting brought a dividend, the normal position of the center of pressure on a delta wing is fairly far forward of where a designer wants it.

The center of gravity of a delta is too far aft of where he wants it, so that the fuselage has to grow in length forward for balance.

Chopping into the leading edge moves the center of pressure aft. The CP/CG relationship becomes conventional. Compare the J35 with other delta-winged aircraft; its shorter nose shows one result of the double delta.

The Draken did not get area-ruled at birth because Whitcomb's theory had not yet been developed. Later on, after the lines were fixed, Saab aerodynamicists got the word and immediately checked the layout of the Draken. Like most delta-winged aircraft, the area distribution wasn't bad, because the wing thickness is well distributed and the maximum thickness is well aft. So the Draken passed with a reasonable area-rule shape and didn't require redesign.

The area distribution is more favorable when the J35 is carrying weapons externally, such as the pair of air-to-air missiles or rocket pods that are to be part of its standard interceptor armament.

Project Growth

At the time of J35 preliminary design there were four engineers. By May, 1950, the group had increased to nine designers and three stressmen under Bratt.

The engineers knew there would be an advantage in having some full-scale flight tests of their unusual layout, particularly at the low-speed end of the flight spectrum where handling characteristics assumed tremendous importance. So they designed the Saab 210, a beautiful little half-scale model of the Draken geometry. The design and drawings took nine months and the shop matched that figure in construction. The 210 flew on Jan. 21, 1952, and made about 1,000 test flights that turned in reams of useful data for the designers. Now, shrouded in tarpaulins, it sits idle in front of the flight test building.

Later in 1952 the detailed design had forced further growth of the team to about 30, and in succeeding years the design group has grown to the current total of about 130 engineers, not

including tooling, lofting, stress and weights group. This is a remarkably low number of people to have turned out detail designs for a high supersonic airplane.

Prototype design started in May 1952, and the first drawings were released to the shop in October, 1953. Two years later the first prototype flew.

(This is the first of two articles on the Saab J35. The second will appear next week.)

Swiss Vote for P.16 As 2nd-Stage Fighter

Geneva—Swiss Parliament Lower House has voted to order 100 Swiss-built P.16 ground support planes as the second stage in the replacement program of the Swiss Air Force.

First stage was the purchase last November of 100 Hawker Hunters at a cost of about $74 million including spares and engines (AW Nov. 25, p. 27).

The decision on the P.16 order was reached after a heated three day debate which reached its climax when a vote of 111 against 36 in favor of "buying Swiss" was taken.

A second vote of 101 against 7 determined that the required 100 Armstrong Siddeley Sapphire engines, plus 50 spares, should be built in Switzerland under license.

Cost is estimated at $103 million of which $7.95 million will be charged to the license-built engines.

The whole matter is now subject to Upper House approval.

The Flug und Fahrzeugwerke A.G. (FFA), Altenrhein, gets the production order with delivery scheduled to be completed by the end of 1962, but the government-sponsored federal aircraft works at Emmen (Edig. Flugzeugwerk) will supervise production including final assembly and flight test. The FFA was bitterly attacked throughout the debate for never having kept any promised delivery date.

Arguments against the highly favored Grumman Super Tiger (F11F-1F) were:

- **It is too expensive.** In January this year Grumman was asking $210 million for 100 of this type. Now, to produce them under license would still cost about $140 million total.
- **Only prototypes** of the modified version suitable for Swiss requirements are available. It is primarily a fighter and to adapt it to ground support work would take at least two years of further development.
- **Its takeoff and landing performance** is not short enough for Swiss conditions.

Toward the end of the debate, the merits of the Grumman Super Tiger were again emphasized and it was recommended to continue present negotiations with Grumman with a view to equipping the Swiss Air Force with a series of Super Tigers as the next stage in its replacement program.

French Continue Cuts In Orders for Aircraft

Paris—As a result of a 25% cut in the 1958 French Air Force budget, several orders for new aircraft were reduced sharply while production rates on other aircraft orders were slowed down.

AVIATION WEEK reported previously (AW March 3, p. 22?) that advanced prototypes such as the Leduc 0.22 ramjet and Sud Aviation supersonic bomber, Super Vautour, have been completely eliminated. Other cuts revealed in National Assembly budget debates include:

- **Dassault Super Mystere.** Original order for 370 aircraft was reduced to 250 and the production rate was reduced from 15 monthly to nine. Super Mystere production models are just now coming off line.
- **Bregnet's original order** for 100 of its anti-submarine turboprop aircraft, Alize, was reduced to 75. First production Alize aircraft is just coming off

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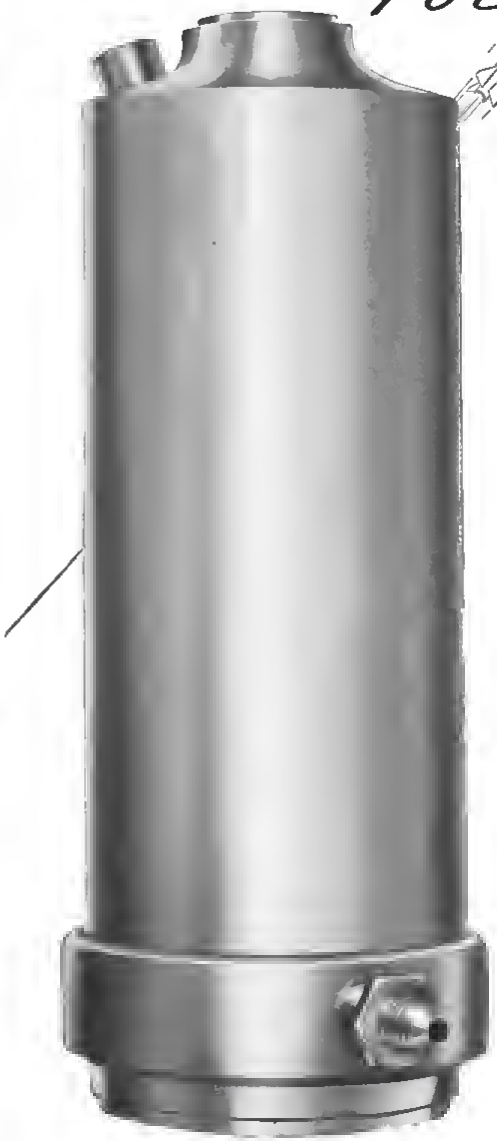

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(Booster engine (left), Sustainer engine (right) shown actual size)

line. Breguet also had its air force order for 15 four engine Sahara cargo aircraft cut to four.

• **Navy** will delay placing an order for 100 Dassault Etendard IVs.

• **Fouga Magister** jet trainer production order will be cut back to six monthly from 12.

• **Sud Aviation Vautour** production rate has been reduced from nine to four. Original order for 360 Vautours, to be delivered in three versions—bomber, all weather fighter and attack—was cut back to 160. Most will be all-weather and attack versions.

French will sell about 25 of the 160 to the Israeli Air Force.

• **Sud Aviation** has had an original order for 250 Djinn helicopters cut back to 120. The original order for 280 Alouettes was sliced to 180.

In addition, 150 Sikorsky S-58 heavy helicopters, which were to be built by Sud Aviation under license, were cut back to 80. Production rates on both the Djinn and Alouette were cut just about 50%.

British Will Spend More for Missiles

London—British Government will step up its spending on missiles during the 1958-59 fiscal year while cutting back purchases of conventional aircraft.

The government reported to the House of Commons last week that overall spending under the 1958-59 air estimates will be $159 million less than in the current fiscal year.

"We are spending less on aircraft," a spokesman said, "although we shall be building up the deterrent with Victors and Vulcans and introducing the Mark 7 Javelin for its defense." He said the decrease in expenditure on aircraft is partly offset by increased spending on armament, ammunition, missiles and weapons of all kinds. Spending on airframes and engines is down 22% while on the other categories it is up 50%.

First production deliveries of the

T-37 Engine Award

Award of an $8,352,272 contract to the Continental Aviation & Engineering Co., Detroit, for jet aircraft engines has been announced by the Air Materiel Command, Wright-Patterson AFB, Dayton, Ohio.

The engines are for the twin jet T-37 Air Force training plane.

The Detroit contract was one of three totaling more than $25 million awarded. The other contracts went to United Aircraft Corp., Stratford, Conn., $16.8 million, and Ryan Aeronautical Co., San Diego, $1,387,293.

de Havilland Firestreak, are scheduled during the year and service trials of the Bristol Bloodhound surface-to-air missile will begin within the next few weeks at North Coates.

Twenty-eight million dollars will be spent on American missiles during the year, it was reported, an expenditure denounced by opposition spokesmen.

Total spending under the 1958-59 air estimates is to be $1.3 billion, $56 million under the current year's estimates. Because there is no U.S. aid in the new estimates, and because German contributions to maintainance of the Royal Air Force in Germany will be less, overall reductions amount to the $159 million figure.

Other points made during the air debate:

- **English Electric's P.1** will come into service with fighter command during the year.
- **Javelin Mark 7 and Mark 8** are to be equipped with afterburners to extend their effective life.
- **Blackburn's NA 39** supersonic naval strike aircraft, powered by twin de Havilland Gyron Junior turbojets, is being considered for the Royal Air Force as well as designs put forward by industry in reply to a general operational requirement for an aircraft to replace the Canberra.
- **Discussions** are underway with the Army on a successor to the Blackburn Beverley transport.
- **Some 260 V-bombers** have been ordered, including 77 Victors, 75 Vulcans and 108 Valiants, of which 160 aircraft have been produced.
- **Britain's V-bombers** are capable of making the roundtrip to Moscow without aerial refueling.
- **Work is almost complete** on V-bomber bases and the radar chain.

USAF Housing

Model shows USAF officers' quarters to be built at Mather AFB, Calif. Designed to combat rising land costs, building would be eight stories high and would house 408 men. Construction would be of exposed concrete with aluminum windows and louvers. Cost is put at $3 million. Facility is designed to stay within Congressional limitation of $7,500 per man. Unit is prototype for future construction at other air bases.

USAF Seeks Weapon Environment Data

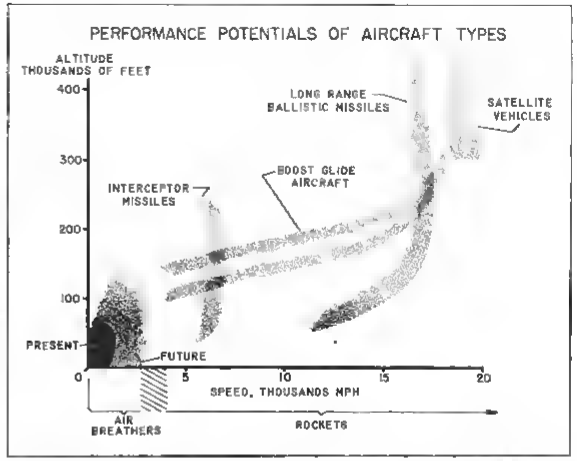
By James A. Fusca

Air Force weapon systems of the future will have to live and fight at altitudes varying from the present operational ceiling of about 75,000 ft. to interplanetary space itself.

Natural and induced environmental conditions encountered at these altitudes, called hyper environments, are being studied for USAF by Radio Corp. of America to assure suitability of future weapon systems through analysis of available knowledge and development of simulation techniques for integrated testing of subsystems, equipment and components.

Philosophy of the study has been to develop ideas for design of simulation facilities capable of operating over the limits of the different environments wherever possible and which will be applicable to many types of equipments and systems.

Study is being conducted for the Environmental Criteria Branch of USAF's Wright Air Development Center by RCA's Defense Electronic Products Division. First part of the study—assembly and analysis of available data—has been published as WADC Technical Report 57-456, by R. A. DiTaranto and J. J. Lamb.



PREDICTED operating ranges of future manned and unmanned aircraft and missiles. Boost glide vehicle, according to National Advisory Committee for Aeronautics, is generally powered during first few seconds of flight, after re-entry, it approaches target in hypersonic glide.

Future Weapon Systems

For purposes of the study, future USAF weapon systems are classified as:

- **Sustained flight vehicles.** These are the powered vehicles deriving most of their lift from aerodynamic means (the remainder from centrifugal force). Maximum altitude of flight is arbitrarily defined as 150,000 ft.
- **Boost glide vehicle.** These are vehicles which generally are powered for the first few seconds of flight, rise above the atmosphere, re-enter and reach their destination in a hypersonic glide, and land conventionally (using lifting surfaces). Altitude and speed limits for this vehicle are considered to be from 100,000 ft. and 4,000 mph. to 300,000 ft. and 18,000 mph.
- **Ballistic vehicle.** This vehicle is powered during its first few seconds of flight, rises above the atmosphere, and follows a ballistic trajectory to its target (no contributing aerodynamic lift). Altitude and speed limits for this vehicle are considered to be 75,000 ft. at 11,000 mph. and 450,000 ft. at 18,000 mph.
- **Satellite vehicle.** These are vehicles placed in an orbit so that their velocity generates a centrifugal force equal to the earth's attraction. Altitude and speed limits of this vehicle are 350,000 ft. at 20,000 mph. and no upper limit.

These future weapon systems will be exposed to two kinds of environmental conditions: those present naturally above the minimum altitude, and those created by the operations of the vehicle and interaction between the vehicle and the natural environment.

Environments generated by operation of the vehicle might include shock, vibration and acoustic excitation during takeoff, landing or powerplant operation as well as operation of rotating or oscillating equipment within the vehicle.

Interaction with the natural environment could cause such effects as vibratory oscillations due to aeroelastic effects, high acoustic noise from aerodynamic effects, and high temperatures resulting from high speeds.

Specific induced environments considered are:

- Temperature.
- Acceleration.
- Vibration.
- Shock.
- Zero gravity.

Induced environments are highly dependent upon design of the particular vehicle in question. Induced temperature, for example, is dependent to a large degree upon weight of the vehicle, cooling system, shape, size, range, altitude, velocity and boundary layer condition.

Natural Environment

Although much moderately accurate data is available on the natural environments encountered at high altitudes, and more is being gathered as part of the International Geophysical Year and similar projects, actual knowledge of these environments will best be gained from a relatively long duration, well instrumented satellite.

Natural environments considered in the study are:

- Atmospheric composition.
- Extremely high vacuum.
- Solar radiation.
- Ozone.
- Dissociated gases.
- Aurorae.
- Ionized gases.
- Solid particles.
- Magnetic field.

Two types of temperature environment are found in aircraft, missile and

satellite flight. Thermodynamic heating occurs as missiles or satellite rockets pass through the atmosphere into space and during all high speed phases of winged aircraft flight. Satellites in orbit, on the other hand, will be subjected to radiant heating from the sun.

Present state of the art of aerodynamic heating permits calculation of the temperatures of boundary layers of air at high velocities. At altitudes to 250,000 ft in Mach 4 flight, temperature of boundary layer air is about 1,400-1,600F. At Mach 6, temperature is 3,100-3,500F.

These temperatures, however, are not the skin temperatures of the vehicle. Skin temperature is a function of cooling, heat sinks, radiation losses and time in the high temperature environment.

For the sustained flight vehicle with a mission time of one to two hours, predicted maximum skin temperature is 2,000F. Internal temperatures will vary as a function of design but the proposed value for internal ambient temperature is 930F with an initial rise from −65 to 930F within 10 min.

Boost glide vehicles although capable of generating temperatures beyond the melting point of structural materials, have been assigned a nominal value for external heating of 2,000F. Both external and internal temperatures will vary with the flight path of the vehicle, although for vehicles remaining below 160,000 ft temperatures should remain almost constant as they do in sustained flight.

Ballistic vehicle temperatures should approximate those of the boost glide vehicle except that the flight path indicates heating from the ground up about 160,000 ft, radiation cooling through apogee to re-entry. Temperatures at re-entry should be kept below 2,000F externally and 930F internally.

Satellite would be protected from high temperatures on ascent by an artificial nose cone. In orbit, normally encountered temperatures would be −40 to 175F.

Acceleration Values

For all types of vehicles, values of acceleration to which they are exposed probably will be greatest in ground handling and on takeoff and landing. Above 75,000 ft and below 300,000 ft, anticipated accelerations are less than 10Gs.

Re-entry accelerations of 8Gs for one minute are anticipated for the boost glide vehicle. The ballistic vehicle may attain 60Gs deceleration. Now high G values are expected above 300,000 ft.

Some of the deleterious effects resulting from accelerations are higher than normal effective pressures are induced in fuel and hydraulic lines, etc., relays with their contacts oriented along the direction of acceleration may not be pulled out by the magnet, acceleration may cause bottoming or change characteristics of vibration damping devices.

All vehicles will be subjected to vibration and acoustic excitation, the magnitude and frequencies of which will primarily be determined by the power plant used.

Highest magnitude of vibrations occur during boost or launch, lasting about 10 sec. Acoustic excitation due to the powerplant will be very great on the ground and at takeoff because of the higher power requirements of these vehicles. This effect will be increased by ground reflections.

Acoustic excitation also will increase with speed. As the vehicle reaches altitudes where air density is very low, the aerodynamic acoustic energy decreases and the powerplant acoustic energy is not propagated by the air to the rest of the vehicle. At these altitudes the powerplant mechanical excitation still exists, and all surfaces which are being excited increase their amplitude of motion because of the lack of air damping which takes place in denser air. Inside the skin, the acoustic excitation is caused by the vibrating surfaces and is dependent upon the density of the air within the skin structure.

In general, shocks encountered in transportation and handling of missiles and allied equipment are more severe

than in normal operations. Highest magnitude of shocks has been the result of irregular burning of solid propellants, booster separation and similar circumstances.

Above 75,000 ft., operational shocks would be due to booster separation near hits by enemy action and wind gusts. Booster separation shocks as large as 200Gs are possible. Wind gusts will cause shocks dependent on gust intensity and on the speed and size of the vehicle. Above 300,000 ft. no non-catastrophic shocks are anticipated.

Zero Gravity

Future vehicles will be traveling at speeds where part of the lift counteracting the force of gravity will be due to centrifugal force. As with orbiting satellites, vehicle equipment may have to function at or near zero gravity.

Of all the high altitude effects, probably the zero gravity condition gives rise to some of the most unusual effects. These include:

- **Air bubbles** may not rise in batteries and so may contaminate the plates, reducing or stopping the flow of current from the battery.
- **Direction sensitive** devices may not operate correctly.
- **Pumps designed to operate** on the ground may not work because hydraulic heads present on earth would not exist in a zero gravity condition.
- **No tendency** for mass movements of air. Heat transfer due to convection will not take place as hot gases won't rise.
- **Clearances** in spring mounted equipment will change.
- **Devices working** on fluid level will not operate properly.

(This is the first of a series of two articles on hyper environments. The second, describing results of analysis of natural environments, will appear in next week's issue.)

Cornell Klystron Lifts Microwave Pulses to Record Power Radiation

Buffalo—Microwave pulses with a peak power of 21 million watts, believed to be the largest peak power ever radiated, has been transmitted by Cornell Aeronautical Laboratory by means of a specially adapted, continuously pumped klystron.

Performed under a research contract with Army Ordnance, the achievement is significant to the future development of ICBM detection equipment, Army says. Project, however, was without funds for three months during the fall federal budget-cutting period.

Klystron developing the large peak power has been adapted from klystrons used in the Stanford University linear accelerator and built by Varian Bros. Tube requires continuous pumping to maintain sufficiently high vacuum.

Problem of detecting an ICBM warhead with a relatively low radar cross section at very large distances requires one or both of the following improvements to conventional radars:

- **High power.** Detectability of a warhead is a direct function of the average power illuminating the target. Average power on target can be increased by increasing the length of the radar pulse as is done with Lincoln Laboratory's Millstone Hill radar, or by increasing the peak power transmitted as would be done with a radar utilizing the Cornell technique.
- **Signal analysis.** More than a dozen companies throughout the country are working on techniques for "fine structure analysis" of radar return signals. These techniques—for example, Columbia University's Omnirange Digital Radar (ORDIR) (AW Aug. 19, p. 28)—integrate the received signal over a sufficient period of time to raise its strength from far below the noise level of the receiver to a level where it can be analyzed on a cycle-to-cycle basis.

System developed by Cornell consists of the large Varian S-band klystron, vacuum pumping equipment, high power modulator, control console, plus a waveguide run to an eight-foot parabolic antenna on the roof. Transmitted pulses are two microseconds in length, with a 60 cycle prf that brings the average power to above three kilowatts.

Primary problem faced in the project was coupling the generated microwave energy through the waveguide and antenna system into free space. To prevent breakdown of the S-band waveguide at the high power levels under study, waveguide is pumped down to a moderate vacuum.

Special irises had to be developed. One of several approaches exploited consisted of using a spherically shaped "iris" to couple the waveguide feedhorn to air, where the fixed parabolic antenna beams the energy into space at about a 45 deg. angle.

Spokesman for the Cornell Aeronautical Laboratory said that many experts in the microwave field held the opinion that the highest usable power that could be generated was about five megawatts, and that therefore the Cornell project was impossible.

Most logical continuation of the program would appear to be raising of the average transmitted power and exploring problems involved in applying the technique to an operating radar.

CESSNA 175, company's newest addition to its business line. Four place airplane, powered by Continental GO-300-A geared engine, is particularly suitable to high altitude flight. New floating cowl suspension modulates engine noise.

Aviation Week Pilot Report:

Gearing Sparks Cessna 175 Performance

By Robert I. Stanfield

New York—Power and efficiency sparked by its six cylinder, 175 hp. Continental GO-300-A geared engine mark Cessna's sixth and newest addition to its business line: the single engine, all metal, four place Model 175.

Power geared engine, with .75 to 1 gear ratio, generates 3,200 rpm at takeoff.

Reduction gears for propeller drive turn prop at three-fourths of engine crankshaft speed (providing prop speed of 2,400 rpm. at rated engine speed of 3,200 rpm.). Maximum rpm. can be maintained to 10,000 ft. Fuel grade is 80/87 octane. Dry weight of engine is 314 lb. Compression ratio is 7.3:1 and cu. in. displacement is 301.37.

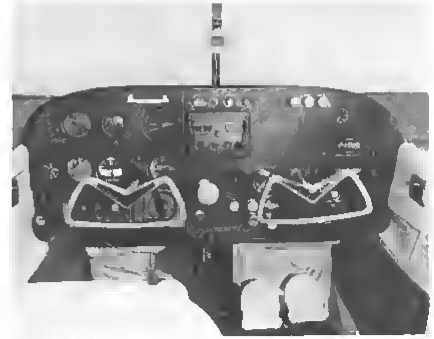
Key characteristics evidenced during flight evaluation by AVIATION WEEK included:

- **High altitude performance.** At 10,000 ft., pulling 70% power—3,150 rpm.—airplane with full complement indicated 135 mph. for TAS of 156 mph.
- **Rate of climb.** Efficiency of McCauley fixed pitch metal propeller, 84 in. dia., with ground clearance of 12 in., noted during takeoff and climb at maximum gross weight 1,200 fpm. at takeoff, 1,100 fpm. at 4,000 ft., 700 fpm. at 7,000 ft.
- **Noise level.** Engine sound is noticeably modulated. Cessna ties reduction to geared engine principle, plus its new floating cowl suspension in which cowl is attached to channel aluminum ring fastened to four engine mounting points, instead of being rigidly fastened to airframe. Cowl floats freely over edge of firewall.

Market Range

With base price of $10,995 f.a.f. Wichita, 175 is aimed at market falling between Cessna's 172 and models 180, 182 and the Skylane.

Airplane 1 flew 56th off the production line; was N9256B. With instrumentation, dual controls, speed fairings (wheel pants), full fuel load and



BUBBLE-TYPE contour windshield adds to 175's styling. Contour is formed by air pressure with no additional molding by hand. New panel mounts flight instruments on left side, controls center, engine instruments right; radios on center line.

four of us aboard. 175 grossed out at maximum—2,350 lb.

New paint scheme enhanced 175's sleek lines. Bubble-type contour windshield added to its styling. To cut down drag and seal out elements, Cessna designed top of instrument panel with built-in receptacle to receive bottom of windshield.

Walk-around inspection also showed thoroughness of company's cowl suspension. Feature may be extended to all of Cessna line, AVIATION WEEK was told. Engine mounting points holding cowl are connected to rubber shock mounts. These are fastened directly to the engine mounts. Bolt attaching engine mounts to firewall supports rubber shock mounts is aimed at cushioning noise and vibration. Both the upper and lower cowl may be removed independently.

Oil cooler, standard equipment, is mounted directly on engine. Carburetor is Marvel NA4-5 float type. Intake system is routed through oil sump. Stainless steel mufflers are included. Provision is made for optional installation of engine-driven vacuum pump. Battery is aft of luggage compartment and is accessible through panel door.

Weather was favorable for transition. Wind was from the NW at 15 kt. Sea level pressure was 30.16 in. (1021.7 mb.). Outside air temperature was 38F.

Airplane was boarded via rear step up to cabin. Foam rubber seating was comfortable—we had two big men in the back—and seats could be adjusted fore and aft for ease of flying.

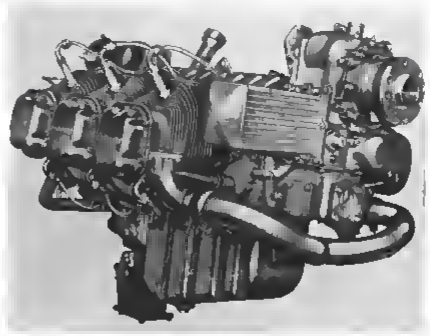
Preflight Check

Cockpit check showed fuel selector valve on floor between front seats. Four-position valve—left, right, both and off—was positioned on "both" for normal procedure for takeoff and landing. Starting procedures are simple. With throttle cracked, engine fired quickly without any prime. Engine instruments located on right side of new instrument panel went right to the green.

New panel mounts all flight instruments on left side, directly in front of pilot. Radios are mounted on center line of right side panel. Electrical switches are grouped top center, engine controls, including throttle, bottom center. Fuel gages are electric. Instruments and controls are easily read and accessible to both pilots.

Taxiing was smooth and visibility was good. Light pressure was required for turns, even over rough terrain. Nose wheel travel travels 30 deg. left or right and is hooked into rudder control.

Before taking runway, mags were checked at 1,600 rpm. and we were ready to go. We had trimmed nose down a few degrees, left our flaps up



CONTINENTAL GO-300-A six-cylinder, 175 hp. geared engine is rated at 3,200 rpm. Crankshaft is geared to propeller shaft. Reduction gears turn prop at three-fourths engine crankshaft speed. Battery (right) sits aft of luggage compartment.

—Cessna recommends 20 deg. of flaps with zero wind—and applied full power.

Airplane went smoothly down runway; here reduced noise level was evident.

Nose wheel lifted at about 40 mph with little back pressure. We were airborne in slightly over 500 ft.; initial climb was at rate of 1,200 fpm.

Despite the load there was no strain in climb. While 86 mph is the suggested climb speed, we found straight-ahead visibility too limited because of a nose-high attitude.

We varied climb between 90-100 mph. and got fine results: good rate of climb and visibility.

At 4,000 ft. we had 1,100 fpm rate of climb at 90 mph. Holding this speed, and generating 2,800 rpm., we held 700 fpm. through 5,500 and 7,000 ft. Leaving 9,000 ft. we dropped back to 83 mph. indicated and held 500 fpm. until we leveled off at 10,000. Throughout climb Cessna 175 was quite stable; only slight trim was required for hands-off flying.

Hands-Off Trim

At 10,000 ft., outside air temperature was 15F. With mixture leaned back, airplane trimmed hands-off and with power at 70%—3,150 rpm.—our TAS was 156 mph. Airspeed is redlined at 176 mph. Caution line (yellow) runs from 140 to 176 mph. Performance at this altitude was excellent. Here was checked what Cessna representatives termed "zero trim stability."

Putting 175 into moderate turn, and adjusting trim, the controls were neutralized. Airplane continued hands-off rate of turn, holding airspeed and altitude. Through 360 deg. cycle there was no variation or hunting. Retarding power to 2,500 rpm., level flight, flaps down, airspeed was reduced to 40 mph. indicated (46 mph. TAS). Stability remained good at this speed and there was little strain in holding airplane level.

We ran through a series of power on, power off stalls, with and without flaps, at 10,000 ft.

With power off, no flaps the airplane was pulled up straight ahead, followed by climbing turns to left and right. In each instance stall warning sounded at about 55 mph. indicated and light buffeting preceded stalls, which broke at about 45-47 mph. There was no clean break and sudden loss of altitude, rather a case of buffeting and breakaway, with altitude loss of about 150 ft.

With full flaps airplane stalled between 30-35 mph. IAS, again preceded

Cessna 175

SPECIFICATIONS AND PERFORMANCE

		Landplane	Seaplane
Engine:	Continental GO-300-A (6 cyl.) hp	175	175
Propeller:	McCauley Fixed Pitch Metal	FC 74/67	FC 84/55
Speed:	Maximum @ Sea Level mph	147*	120†
	Maximum Recommended Cruise @ 10,000 ft., mph. (Landplane 70% power, **Seaplane 60% power)	139	113
Range:	Range @ Maximum Recommended Cruise		
	Miles (based on 43 gal. usable)	595	560
	Hours	4.3	4.9
	True Airspeed mph	139	113
	Maximum Range (10,000 ft., no reserve)		
	Miles (based on 43 gal. usable)	720	665
	Hours	7.0	7.0
	True Airspeed, mph	102	86
Rate of Climb (sea level), ft. min.		850	850
Service Ceiling, ft.		15,900	13,250
Takeoff, ground run (sea level, zero wind, 20 deg. flaps)		735'	
Takeoff, ground run, over 50' obstacle		1,340'	
Landing ground roll, (sea level, 40 deg. or full flaps)		590	
Landing roll, over 50' obstacle		1,057'	
Gross Weight, lb.		2,350	2,350
Empty Weight, lb.		1,312	1,524
Luggage Compartment Capacity, lb.		120	120
Fuel Capacity, gal.		52	52
Span, ft.		36	36
Length, ft., in.		24	25' 2"
Height, ft., in.		8' 6"	12' 3"
Wing Area, sq. ft.		175	175
Wing Loading, lb./sq. ft.		13.4	13.4
Power Loading lb./hp.		13.4	13.4

* 175 bhp. † 3,200 rpm. ** Limited by max. allowable rpm.

by early stall warning and buffeting and followed by small loss of altitude. Lateral stability was good throughout series.

With power on—2,500 rpm—and flaps up, airplane was pulled nose high first right, then left. Pre stall characteristics were similar, but break was reluctant and altitude loss did not exceed 100 ft. Lowering 10 deg. flaps, on simulated base leg, we pulled nose high in "final approach" turn and lost little altitude as stall buffeted us along at 35 mph. indicated.

Letting down to 7,000 ft., we held cruise power of 3,100 rpm. Again at 70% power, outside air temperature was 24F, our indicated speed was 136 mph. for a true reading of 150 mph.

Fuel and Range

At maximum recommended cruise (70% power) airplane's range at 10,000 ft. is specified at 595 mi., maximum range, at same altitude (39% power) with no reserve, is 720 mi. Figures are based on 43 gal. useable fuel, rather than total 52-gal. capacity. Portion of remaining nine gallons will be used in taxi, run-up, takeoff and climb to cruise altitude.

Because of gravity fuel system, about 4.5 gal. in one tank would offset extreme flight configuration of airplane during which fuel would not reach tank outlet.

With the 175, this would be an extremely steep climb, plus slipping and skidding at high angle—best angle of climb, 25-30 deg., at lowest flying weight at sea level.

Despite cold at altitude, cabin heater kept inside air at comfortable level. Seating held us high enough for good visibility, yet not beyond eyeangle that makes for ease of instrument flying.

Landings in the 175 are no problem. Neither is runway length; airplane has excellent short-field capabilities.

Best approach speeds are specified as 70-80 mph. without flaps, 65-75 mph. with flaps. Degrees of variation, of course, depends on runway and wind conditions, plus gross weight.

At slightly less than maximum gross, we tried dropping 10 deg. of flaps on base, full flaps after turning final. A little elevator trim, and we had established good angle of descent. At 70 mph. airplane handled smoothly, control and stability remained good. With little braking action we were on and off in slightly over 400 ft.

For short-field work we dropped 20 deg. of flaps for takeoff, pushed throttle full forward before releasing brakes. Nose was held down for slightly over 100 ft. of runway. We pulled off the ground—with 16 kt. wind—within 130 ft.

Again using full flaps on approach, but with moderate brake application

airplane was decked and turned off within 150 ft.

During transition work—varying from sea level to 10,000 ft—fuel consumption ran about 7.5 gal./hr.

Airplane we flew was equipped with Cessna's Group 2B instrumentation: Narco Superhomer (VHF-3 with nine crystals), turn and bank, rate of climb, sensitive altimeter, clock, outside air temperature gage, sun visors and landing light (dual lights installed in left wing). Cost installed at factory: $1,100. Weight: 25.5 lb.

Dual controls, an optional item, are priced at $47.50. Speed fairings, which Cessna estimates add another 3 mph. to airspeed, run $195. Total cost of N9256B approximated $12,337.

Cessna offers eight other instrumentation packages in addition to Group 2B. Included among these are:

- **Group 1,** embracing basic instrumentation of 2B. However, in place of Narco Superhomer is Lear LTRA-61S with Omnimeter (seven crystals—121.5 through 122.8), and Narco Simplexer VC-27 (25 crystals—118.1 through 126.7). Cost: $2,350. Weight: 56.5 lb.
- **Group 2,** which follows same pattern but in place of 2B's Superhomer is Narco Omnigator Mark II (24 crystals—118.0 through 123.0 low band). Cost: $1,635. Weight: 32 lb.
- **Group 3,** which consists solely of basic instrumentation of 2B: minus Superhomer, along with cabin speaker and low frequency antenna and mast.

Similar variations are offered in other packages such as firm's 2L instrumentation which is similar to Group 2, except that Smart 55-DTR replaces Narco Omnigator. Cost: $1,150. Weight: 44.5 lb.

All radio installations include cabin speaker, microphone, headphones and necessary antennas.

175 on Floats

Cessna expects to manufacture Model 175 with float fittings for April delivery. Tests have been completed at Grand Lake, Okla., and firm is awaiting CAA approval for float operations.

Seaplane will rest on new Edo floats, model 338-2200, similar in design to the 249-2870 floats used on the 180. Each float has seven watertight compartments. Each alone will support 2,200 lb. fresh water displacement at 175's gross weight of 2,350 lb. This leaves reserve buoyancy of about 90% in fully-loaded seaplane.

Edo representative told AVIATION WEEK that floats would be finished internally with two coats of zinc chromate paint. Externally there would be prime coat of zinc chromate, which is suitable as base for finishing coat of either lacquer or enamel.

Standard float equipment would in-

clude single water rudder for right hand float Optional equipment, for field installation, would be water rudder kit for left-hand float Two rudders are particularly applicable in confined water areas such as bayous

Floats list at $4,250, complete with attachment gear Production weight with gear is 293 lb By comparison weight of Edo Model 2000 floats (for Cessna 170) is 243 lb, that of Model 2870 (for Cessna 180) is 378 lb

Corrosion proofing runs to $425 Cost of fittings (bolt-type attachment) is $190

Dealer Showings

Cessna is curently producing the 175 at rate of five per day There are approximately 150 off the line New model will be introduced nationally at a series of dealer showings on March 29 and 30 Showings will be preceded by mass factory-to-dealer flyaway of about 150 aircraft on March 27

Company feels that primary prospects for 175 will be owners of four place airplanes in low priced field, and non-owners Its single-engine sales to the latter is presently about 30%

Model 175 colors available include red, orange, black and green, with white for striping In addition to speed fairings rotating beacon ($145) will be offered as optional equipment

Narco Improves Customer Warranty

Major improvement in customary 90 day warranty on its communications and navigation equipment, aimed at speeding claims and service, has been inaugurated by National Aeronautical Corp (Narco) on a nationwide basis

New formula will provide customers with free bench check and correction of equipment malfunction, excepting removal and reinstallation at any Narco designated warranty service agency There are 80 of these agencies now and company plans to expand the list to approximately 150

Company recognizes that most malfunctions crop up during first 25-50 hr of use after equipment is installed in a customer's aircraft Previously, customer's best recourse in event of a malfunction, was to bring equipment back to purchase point Narco's new plan is aimed at minimizing inconvenience to user should malfunction occur while he is away from point of purchase, by providing similar service at nearest authorized station

Under the new program, customer receives a warranty application form at time of purchase Form is filled in and returned to Narco Customer receives a warranty service certificate covering 90 days

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LETTERS

Space Force

I have been a subscriber to your magazine for the past several years, and find it one of the best in its field. One of the most interesting columns I enjoy in the publication is the Letters page, offering a variety of constructive criticisms and opinions submitted by various readers throughout the country.

I have prepared the following short article which I feel may be an approach to one of the greatest political debates of our time.

Why the fuss, investigations and inter service rivalry over space control? The establishment of a new service branch comprised of the top missile and space personnel (civilian and military) from the existing services may well overcome this problem.

In past history the United States relied on her Army, Navy, Air Force, Marines and Coast Guard to perform all duties required by a nation's armed forces. This job has been well done. Now that the world has entered into the space age, a new service is warranted, one that may carry out the tasks required in this unexplored medium with the utmost skill and ability obtainable. A Space Force, concerned primarily with space travel, satellite operations and weapon systems having their origin in space. (this does not include surface-to-surface missiles), would be one solution to the military approach of the space age. The hatching of such an agency would, without question, wear a high price tag, but in a short 10 years' time should evaluate itself tricefold. The organizing of a Space Academy on equal status with West Point, Annapolis and the USAF Academy, would produce the grade of men needed, and bring life to a once fictitious space cadet. The man who graduates from such a training program should be ready, well conditioned and prepared to lead men toward the exploration of space when the time arrives.

Let us turn back the pages of history just to over a decade ago when the USAF was reorganized into a completely independent service no longer subject to the Army.

This move should have been executed 20 years prior to when it was, but as it is said, "better late than never." The formation of a United States Space Force will some day become a reality. The groundwork and foundation for such an organization should be laid at present to prevent the problems and setbacks involved with a repeat performance of the Air Force shift.

JOSEPH V. TRIPPONI
College Point, N. Y.

Apprentice Program

On the general subject of "Engineer Shortage" and in particular reply to remarks by Charles F. McMorrow on the Letters page of the Jan. 27 issue, I would like to make the following remarks:

He speaks as an engineering supervisor who is disappointed in engineers whom he interviews. They are interested in money, when they should only be interested in serving an apprenticeship in a rewarding field.

He mentions prostitution.

I have worked for such supervisors as Mr. McMorrow must be. They leaned on a drafting table for 10 or 20 years "apprenticeship" and therefore, their underlings are going to come up the same ladder. No matter that the world of engineering has changed, the apprenticeship program must go on.

His house is paid for. His children are on their own. He truly is not interested in money. Yet he is shocked when younger men are interested in salary. Why, these young squirts get $400.00 a month with no experience! No matter, we'll hold them down once they start to work.

This is the theme of the professional societies since they are largely controlled by engineering supervisors and college faculties. The engineering unions as yet have had no real successes, in a large degree this is due to the fact that their leaders are suddenly promoted to management and so are lost to the unions.

Yet such unions are needed in a world where the wages of carpenters, plumbers, milkmen, etc., are set by union negotiation.

My own solution was much simpler. I left the engineering field (three years in electronics, five years in avionics). I'm making more money now and I think I made the right decision.

I agree with your recent correspondents who feel that there is no engineering shortage in this country.

EX-ENGINEER
New Haven, Conn.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Treasured Secrets

I read with much interest your editorial entitled "Hope of the Nation" (AW Jan. 6). I'm sorry I was not present to witness you and your staff coping with Langford. Although he scares me stiff, the episode is one of the nicest things I've read about in some time.

It reminded me of another anecdote which you ought to add to your voluminous files on security. It was told to a group of Naval air combat intelligence officers who in 1943 were receiving instruction in the art of air combat intelligence from an RAF officer who looked, complete with walrus mustache, exactly as every RAF officer ought to look. His subject for the day was overt intelligence, the case of a new British bomber to illustrate his point.

The bomber—I believe it was the Lancaster—was one of Britain's most treasured military secrets during its development stage.

Naturally, it was shrouded, as we always say, in the deepest of secrecy. So you can imagine the anguish in RAF intelligence when that august group received from the north of England the copy of a small school newspaper which contained a terribly comprehensive and frighteningly accurate description of the new bomber.

Parties of intelligence officers were dispatched to investigate the breach in security. The author of the article was a small boy—well, 12 years or so. After all sorts of indirect approaches had failed to trap him into revealing the source of information, the direct question was asked: How had he got the information about the bomber?

Why hadn't they told him that was what they wanted to know, he inquired reasonably. And he took them up to his room.

It was filled with technical and trade publications—all easily available to the public—on aviation matters. The boy was an aviation lobbyist, and a good one. According to my RAF instructor, he had pieced his whole picture together—and correctly—simply by noting and correlating minor items in the press.

WILLIS PLAYER
Vice President
American Airlines
New York, N. Y.

Public Airing

Further to our letter to you "Civil Service Critic" (AW Dec. 23, p. 102) commenting on the "mass hirings" being conducted by the Civil Service, casual investigation at Holloman Air Force Base, White Sands Proving Grounds and Ft. Bliss in this general area support our contention that the Civil Service are presently hiring anyone and everybody they can lay their hands on, and completely ignoring the fact that as of "Sputnik" Nov. 4 they were told to lay off thousands of "non essential" Civil Service employes!

The majority of these new Civil Service "openings" will do nothing towards our national drive to forward the missile and/or satellite program. Just thousands of more paper pushing, cushy jobs for budding young bureaucrats.

We have personally met some of these "GS electronic engineers". 75% of them had a personal history of "TV servicemen" (who could not make out in that job). Most of them had had "boss troubles," i.e. couldn't get on with their employers. The Civil Service hired them! Many had applied for jobs with industrial concerns, and very naturally been turned down for "lack of experience," "emotional instability," "unsatisfactory references," etc., etc., but Civil Service continues to hire them!

May we suggest that you give this whole matter a good public airing. The taxpayers of this country are entitled to know the exact caliber of the Civil Servants being hired to conduct and presumably supervise our missile/satellite programs.

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